RADIOLOGY

A MONTHLY JOURNAL DEVOTED TO CLINICAL RADIOLOGY AND ALLIED SCIENCES

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Patterns of Lobar Collapse as Observed Radiographically[1]

MORTIMER LUBERT, M.D., AND GEORGE R. KRAUSE, M.D.

Cleveland, Ohio

THE RECOGNITION of lobar collapse is the responsibility of the radiologist, but his obligations do not cease with the diagnosis. He must *convince* the referring physician of its presence, a frequently difficult task. To do this, he must be able to simplify the intricacies and analyze the pitfalls of the diagnosis for the benefit of his colleagues.

Robbins and Hale in a very important series of papers have presented a careful and thoughtful analysis of the radiologic findings in lobar and segmental collapse of the lungs. We have accepted their views on the subject as valid and highly significant, but we frequently have felt the need for further elaboration and more detail, especially from a teaching standpoint. For this purpose, we have reviewed our available material, selections from which will illustrate the typical appearance of lobar collapse, as well as variations from the usual pattern. As a result of this study, we will present in diagrammatic form (Figs. 1, 6, 11, 16) the probable sequence of events which occur in a lobe undergoing collapse. This study also will reveal the underlying unity of what seems to be a varied roentgen picture and will explain the reasons for the typical and atypical roentgen findings.

The terms "collapse," "atelectasis," and "septum" are employed according to the definitions of Robbins and Hale. "Collapse" indicates loss of volume, while "atelectasis" signifies airlessness in addition. In this study we have been particularly interested in the roentgen appearance of the lobe in various stages of collapse and the concurrent changes in the position of the associated interlobar septa as seen in the *lateral view*, so that greatest emphasis has been placed on these aspects of the problem. Other roentgen findings seen in collapse of a lobe, such as change in position and size of the pulmonary root, the groupings of the pulmonary markings, the size of the hemithorax and position of the diaphragm, while extremely important, have been well described and will not primarily concern us in this report.

GENERAL CONSIDERATIONS

In order to understand the mechanism of lobar collapse and the consequent roentgen appearance, it is of primary importance to consider the lung and its major subdivisions as semi-rigid rather than purely elastic structures. Except for the alveoli, collapsed pulmonary tissue cannot be likened to a deflated balloon, although this comparison is frequently made. A number of factors account for this.

The cartilaginous content of the bron-

[1] From the Department of Radiology of Mount Sinai Hospital of Cleveland, Herbert A. Mahrer, M.D., Chief. Accepted for publication in June 1950.

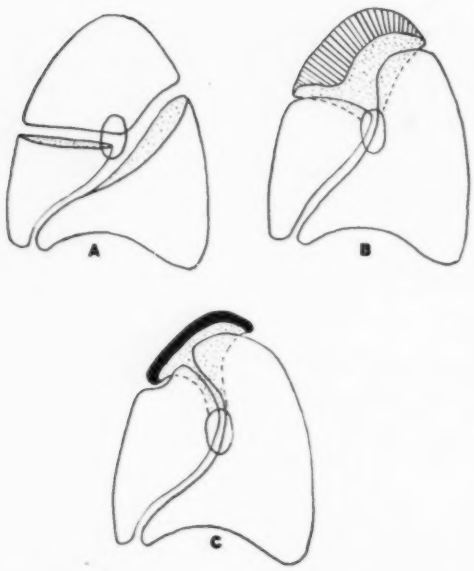

Fig. 1. A schematic representation of progressive collapse of the right upper lobe as seen in the lateral view. Compare with Fig. 6 for appearance of left upper lobe.

A. Status of right upper lobe at inception of collapse.

B. Further collapse of right upper lobe. Note the *upward* displacement of the septum between the collapsing upper lobe and the expanding middle and lower lobes. Cross-hatching designates that portion of the lobe still against the lateral chest wall. The dotted area represents the hilar attachment and "mediastinal wedge."

C. Further progress of collapse. The solid area is the lateral portion of the lobe, now smaller than in B. The "mediastinal wedge" is smaller. The lateral portion eventually disappears, leaving only the "mediastinal wedge."

chial walls causes them to resist distortion. The angle at which the bronchus leaves its parent structure, its length, and the amount of cartilage in its wall in part determine the magnitude and direction of movement, and hence the eventual radiographic appearance of a collapsed lobe.

When a lobe collapses, a potential space is created. This must be filled by diminution in the size of the hemithorax, displacement of mediastinal structures, elevation of the diaphragm, expansion of the adjacent pulmonary tissue, or a combination of any or all of these factors.

The elasticity of the thoracic cage, the flexibility of the mediastinum, and the mobility of the diaphragm may in part compensate for the loss of volume of the collapsed lobe. The greater the degree of rigidity of the thoracic wall, the greater the degree of fixation of the mediastinum, and the less mobile the diaphragm, the larger the potential space which must be filled by expansion of the remaining pulmonary tissue. A more elastic chest wall, a flexible mediastinum, and a mobile diaphragm will result in a lesser degree of complementary emphysema. The appearance of the collapsing lobe is thus modified by the degree of complementary emphysema which the remainder of the lung must undergo.

The ability of the remaining pulmonary tissue to fill the potential space may, however, be seriously affected by two conditions. Intrapulmonary disease, past or present, diminishes elasticity and thus affects the distensibility of the remaining lobes. Adhesive pleuritis, whether interlobar or between the visceral and parietal layers, subtracts from the mobility of the adjacent lobes. Such pleurisy and intrapulmonary disease also may affect the involved lobe and prevent the usual collapse which occurs after bronchial obstruction. Thus it is evident that the typical roentgen appearance of lobar collapse may be altered by the presence of intrapulmonary disease or adhesive pleuritis.

When the loss of volume in a lobe cannot be compensated for by any combination of the above mechanisms, secretion from mucous glands and transudation from alveolar capillaries will minimize the degree of collapse. Collateral air drift plays little, if any, part in distending the alveoli distal to a completely blocked major bronchus.

Interplay among the possible compensatory mechanisms discussed and the effect of pre-existing disease render it difficult to type the roentgen appearance of a collapsed lobe. Nevertheless, when all factors are considered, the basic appearance under a variety of influences is sufficiently similar so that certain generalizations can be made.

In collapse, the lobe does not become a

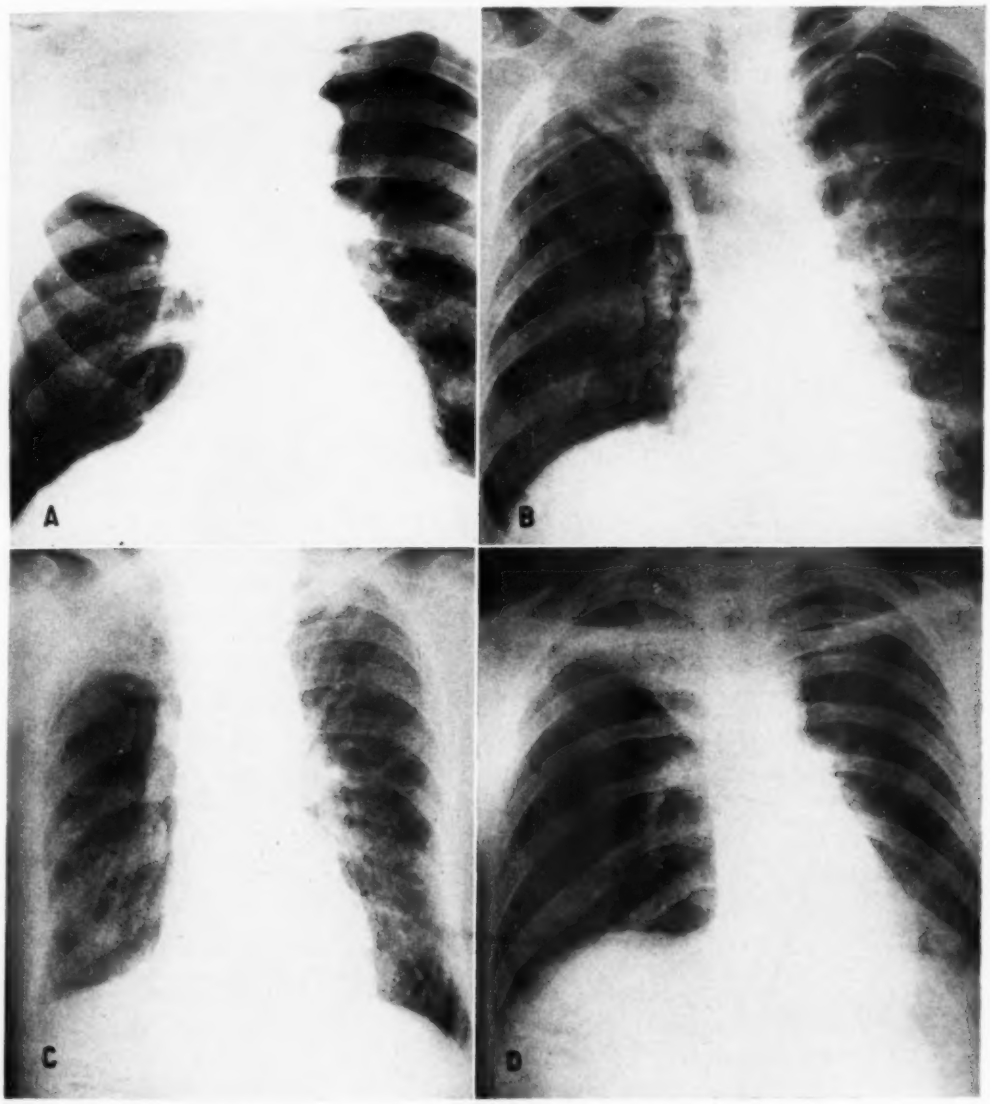

Fig. 2. Postero-anterior views of four cases illustrating different stages of collapse of the right upper lobe. For the corresponding lateral views, see Fig. 3, in which the same alphabetical designation applies. Compare with Fig. 7 for appearance of the left upper lobe in the postero-anterior view during collapse.

A. Slight collapse.

B. Further collapse. Septum is elevated more in its lateral portion. The medial portion is flattening against the mediastinum.

C. Slight variation from B with more equal elevation of septum both medially and laterally.

D. Even more collapse. Septum approaches a vertical position as right upper lobe flattens against the mediastinum.

smaller replica of itself. Instead, there is a rather important *change in shape*. The usual three-dimensional pyramidal or conical configuration is replaced by a flattened triangle with the apex at the hilum, thus approaching a two-dimensional figure. The broad part of this triangle follows the curve of the parietal pleura,

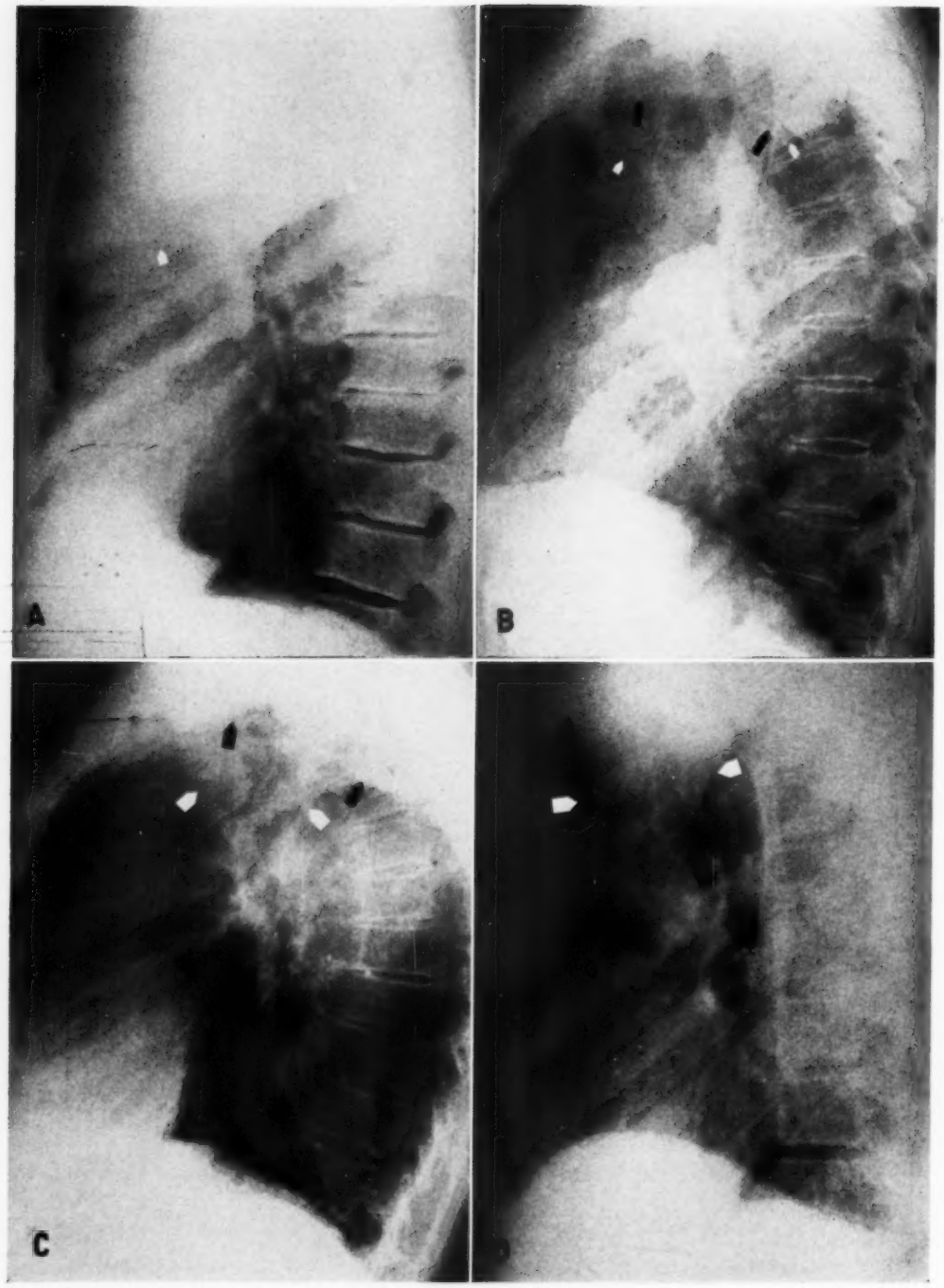

Fig. 3. Lateral radiographs of the four cases shown in Fig. 2, with the same alphabetical designation. Compare with the diagrams in Fig. 1. For the difference between collapse of the right upper lobe (here shown) and the left upper lobe, see Fig. 8.

A. Slight collapse. Arrows point to the septum, which is only slightly displaced *upward*.

B. Further elevation of the septum (black arrows). "Mediastinal wedge" is fairly well seen (white arrows) and contains a cavity.

(*Legend cont. at foot of following page*)

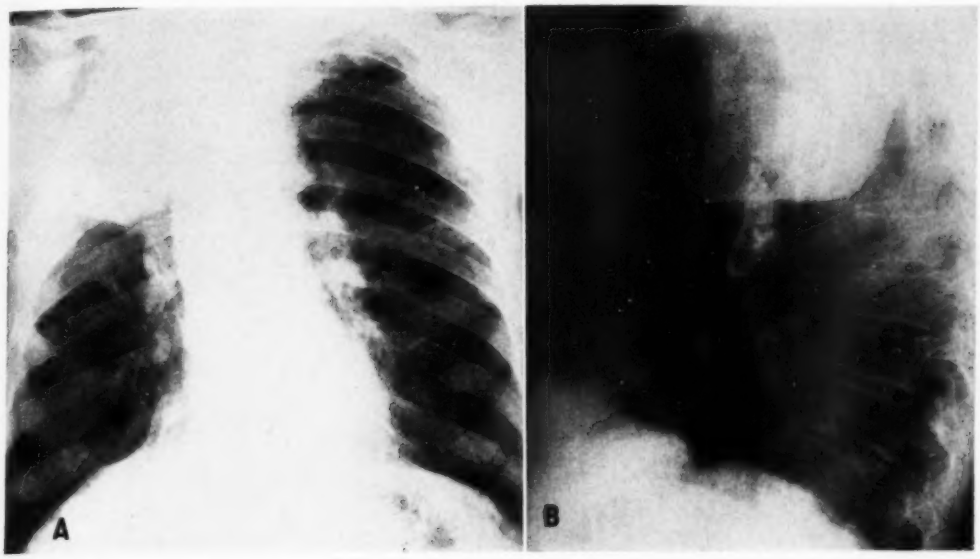

Fig. 4. Atypical collapse. Pattern is the result of pleural adhesions in the axillary subsegments of the right upper lobe.
A. Postero-anterior view is not unusual for lobar collapse.
B. Lateral view shows marked elevation of the anterior and posterior portions of the septum. The mid-portion, which bounds the axillary subsegments at the lateral chest wall, is fixed.

with the base (interlobar septum) lying against the lateral chest wall. Figures 5, 10, 15 diagrammatically illustrate this concept by representing the collapsing lobe as a triangular sheet of paper, bent upon itself.

Since collapse, at least in its inception, is dynamic rather than static, the process continues, with the triangular mass becoming smaller and flatter. The apex of the triangle necessarily remains fixed at the hilum, so that the remainder of the lobe flattens against the mediastinal and parietal pleura and the base moves toward the hilum along the curved course of the chest wall (Figs. 1, 6, 11, 16; Figs. 5, 10, 15).

In the past it has been customary to consider both upper lobes together in discussions of lobar collapse. Certain important differences in anatomy between the upper lobes cause differences in the pattern of collapse and make separate consideration of these lobes imperative.

These differences are: (1) a more vertical course of the major septum on the left compared with the superior portion of the long septum on the right; (2) the presence on the right of a minor septum which together with the superior portion of the long septum delimits the upper lobe, the two acting as a unit during displacement due to lobar collapse; (3) the fact that the lingula is part of the left upper lobe, which thus extends to the diaphragm emphasizing the *anterior* position of the left upper lobe compared to the more *superior* position of the right upper lobe. (Compare Figs. 1A and 6A.)

On the other hand, both lower lobes can be considered together. While the left lower lobe is more posterior and extends more toward the apex of the thoracic cavity, the pattern in collapse of the two lobes is similar.

The considerations of lobar collapse presented above are based on the roentgen

C. Still further elevation of the septum (black arrows). Ill defined "mediastinal wedge" (white arrows).
D. Marked collapse. Septum has disappeared over radiologic apex. Extremely well delineated "mediastinal wedge." Compare with Fig. 8D.

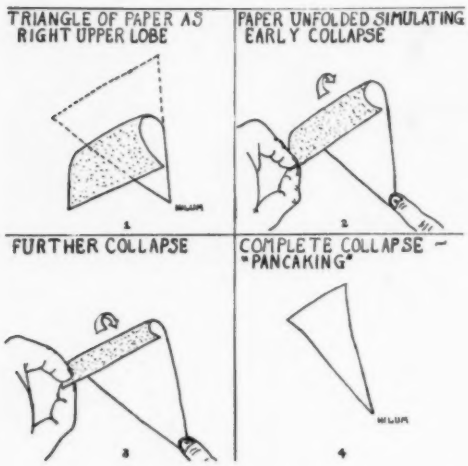
TRIANGLE OF PAPER AS RIGHT UPPER LOBE
PAPER UNFOLDED SIMULATING EARLY COLLAPSE
FURTHER COLLAPSE
COMPLETE COLLAPSE — "PANCAKING"

Fig. 5. The flattened right upper lobe as seen in the lateral view is represented for didactic purposes as a triangular, two-dimensional figure, bent upon itself. The dotted area represents that portion of the lobe against the lateral chest wall and the apex of the thorax. The clear area represents the "mediastinal wedge." The base of the triangle represents the interlobar septum.

Unfolding the triangle along a curved surface and diminution in size are comparable to progressive collapse of the right upper lobe when no limiting factors are present. Note that the lobe and the interlobar septum are displaced *upward*.

findings in a closed thoracic cage without the presence of pneumothorax or any significant pleural fluid. The findings at operation or autopsy are not comparable to the roentgenographic appearances, since pressure relationships have been altered with opening of the thorax. As a consequence, the lobar configuration will not be the same as seen on the radiograph.

THE RIGHT UPPER LOBE

On the right, collapse of the upper lobe results in *upward* shift of the superior portion of the long septum and of the minor septum. If the lobe is free to move (not bound by adhesions to the parietal pleura), if compensating factors are available, and if the original force is still acting, the septum (both parts considered as a unit) continues to move *upward* over the radiologic apex of the thorax until it is no longer visible in the lateral view.

Figure 1 is a schematic illustration of the progressive collapse of the right upper lobe. Figure 3 shows lateral views of different cases corresponding to the stages of collapse as seen in the diagram. When the septum has crossed the radiologic apex of the thorax, the lobe is flattened against the right superior mediastinum and is visible only as a slight widening of the mediastinum in the postero-anterior view (Fig. 2D). In the lateral projection a faint, triangular shadow with the apex at the hilum and the base at the superior thoracic aperture may be seen in certain well exposed radiographs of patients who are not too obese (Figs. 3B, C, D). This has been designated the "mediastinal wedge." In many instances the process may stop short of complete collapse, or surgical intervention may take place, so that for such cases an intermediary position may be the final outcome. The

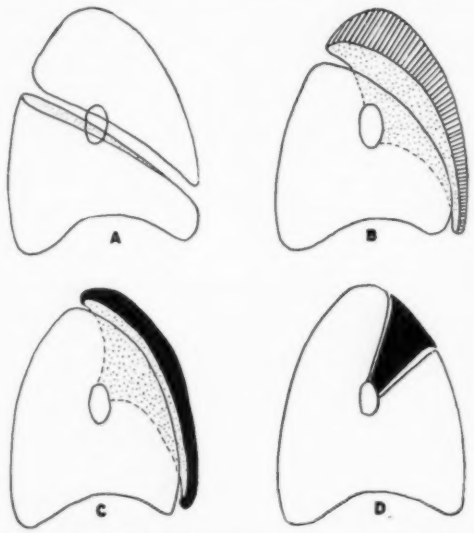

Fig. 6. Schematic representation of progressive collapse of left upper lobe. Compare with Fig. 1 for pattern of right upper lobe.

A. Status of left upper lobe at inception of collapse.

B. Further collapse. Note *anterior* displacement of septum and over-expansion of lower lobe. Cross-hatching designates that portion still against the anterolateral chest wall. The dotted area represents the "mediastinal wedge" and hilar attachment.

C. Progression of collapse. The black area represents the small portion against the anterolateral chest wall.

D. Disappearance of the septum, leaving only the "mediastinal wedge," which is usually not seen as clearly as shown here.

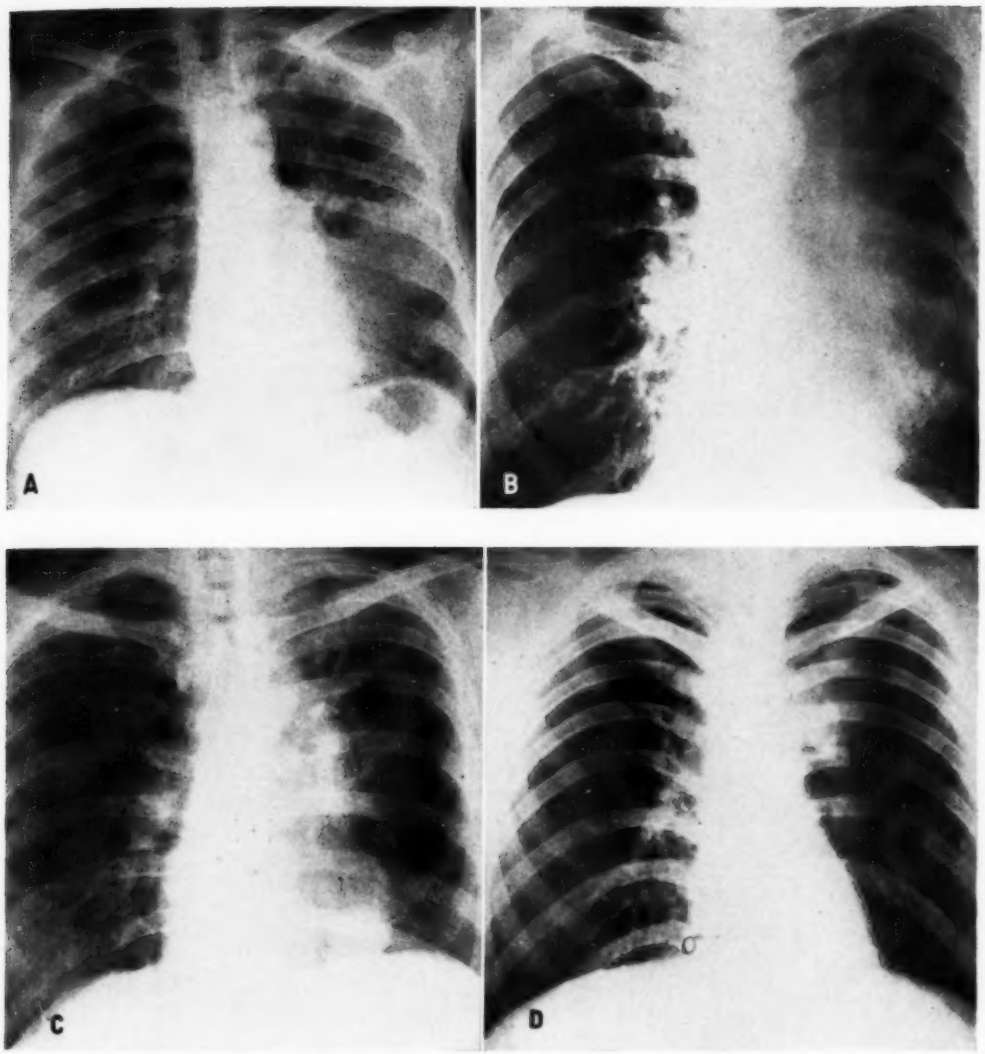

Fig. 7. Postero-anterior views of four cases illustrating different stages of collapse of the left upper lobe. For corresponding lateral views see Fig. 8, which has same alphabetical designations.
A. Slight collapse with some density in lingula.
B. Further collapse. Paracardiac density which fades peripherally.
C. More collapse. Paracardiac density narrower. Emphysematous lower lobe is seen laterally.
D. Extreme collapse of the lobe, now seen as a rounded density in the region of elevated left pulmonary artery. Marked complementary emphysema.

movement of the interlobar septum is illustrated by comparison with the movement of the base of a triangular piece of paper distributed along a curved surface composed of the lateral chest wall, apex of the thoracic cage, and the mediastinal pleura, as seen in Figure 5.

Adhesions may cause fixation of certain portions of a lobe, with other portions free to move. Figures 4A and B illustrate such an instance in which the axillary subsegments are adherent to the parietal pleura, but the remaining portions of the lobe are free to move.

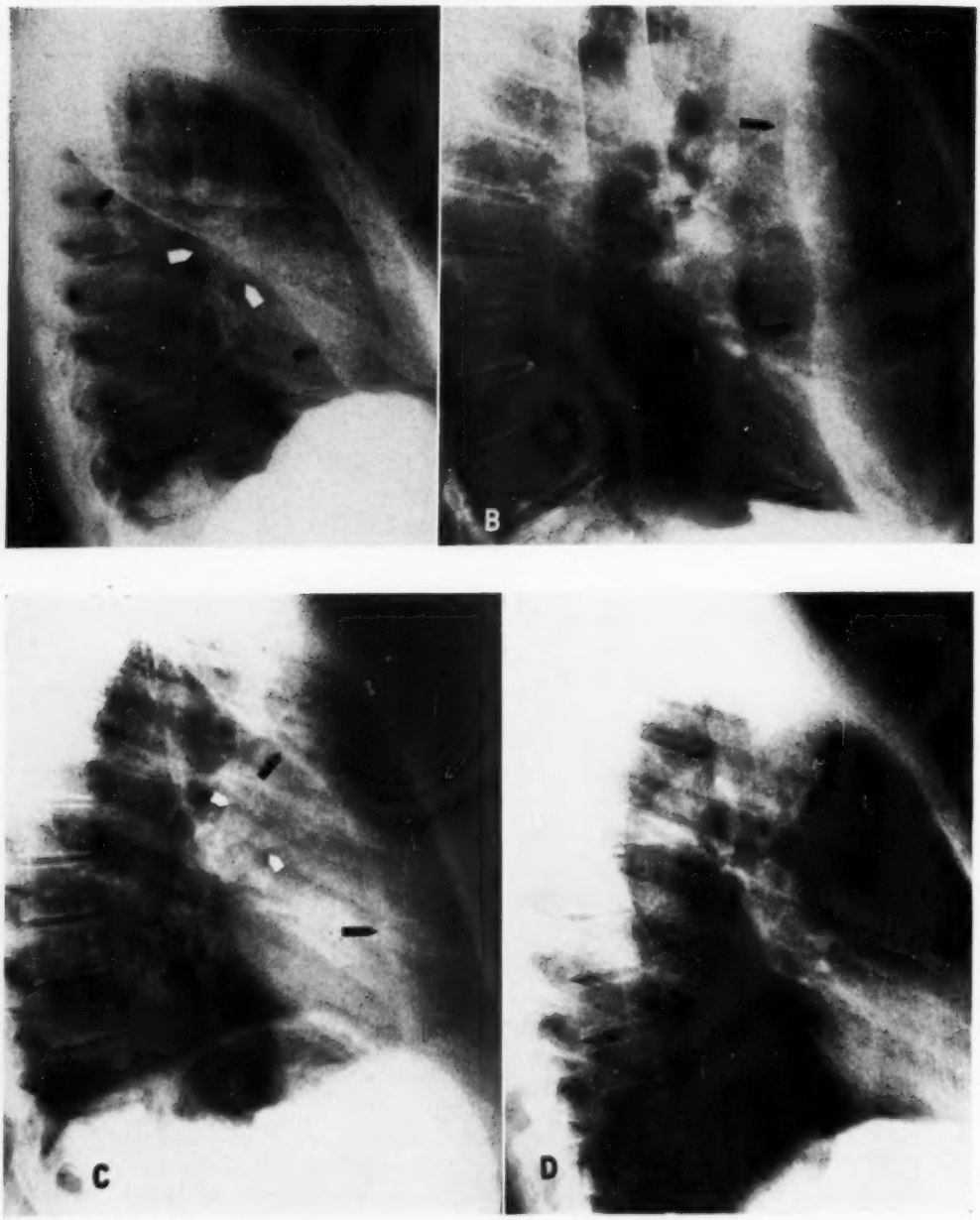

Fig. 8. Lateral radiographs of the cases shown in Fig. 7, in the same order. Different stages of collapse of the left upper lobe. See Fig. 3 for corresponding views of the right upper lobe.

A. Early collapse. Septum designated by black arrows. White arrows point to indefinite "mediastinal wedge."

B. Further collapse. Arrows designate the septum. Marked emphysema of the lower lobe.

C. Collapse of greater degree. Septum (black arrows) close to anterior chest wall. White arrows point to indefinite "mediastinal wedge."

D. Extreme collapse. Septum is no longer visible since it is not in contact with lateral chest wall. "Mediastinal wedge" (arrows) unusually well seen.

When the left upper lobe collapses, the interlobar septum is displaced anteriorly.

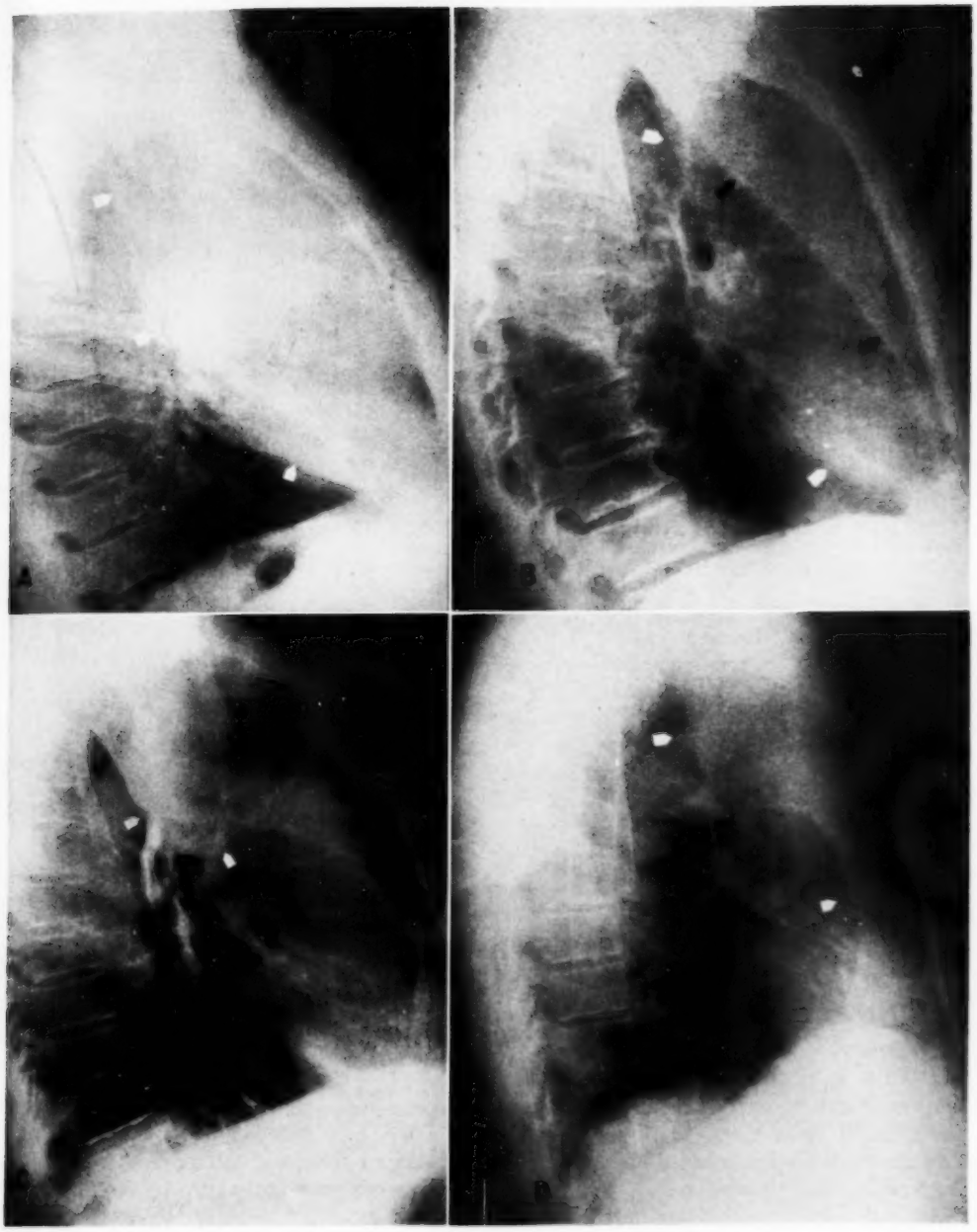

Fig. 9. Unusual appearances of the left upper lobe with bronchial obstruction. Lateral views of four cases.
A. Infiltrated and adherent lobe which cannot contract in the usual fashion. Lobe filled with exudate. Septum shown by arrows.
B. Upper portion of the lobe only slightly less collapsed than lower (lingula). Homogeneous density throughout. Black arrows indicate the septum. White arrows reveal an unusually wide "mediastinal wedge."
C. Upper portion of lobe fixed by adhesions with almost no shrinkage. Lingula markedly contracted and elevated. Black arrows indicate septum. White arrows show fairly clear "mediastinal wedge."
D. Upper portion of lobe shows more collapse with corresponding portion of septum more vertical than in C. White arrows designate septum. "Mediastinal wedge" not clearly seen.

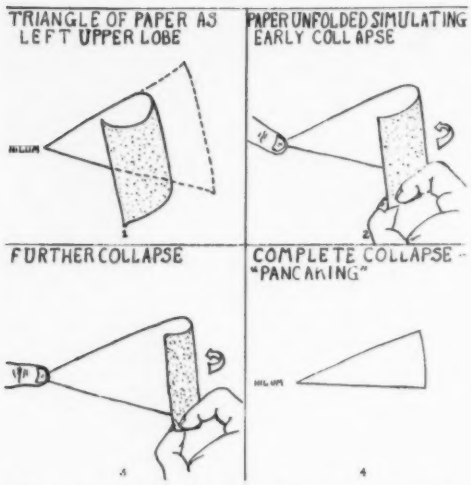
TRIANGLE OF PAPER AS LEFT UPPER LOBE
PAPER UNFOLDED SIMULATING EARLY COLLAPSE
FURTHER COLLAPSE
COMPLETE COLLAPSE "PANCAKING"

Fig. 10. Flattened left upper lobe represented as two-dimensional triangle bent upon itself. The base of the triangle represents the position of the septum at various stages of collapse. During collapse the septum follows the curved contour of the parietal pleura. When contact with lateral chest wall is lost, only the "mediastinal wedge" remains.

LEFT UPPER LOBE

The vertical position of the interlobar septum on the left and the anterior location of the left upper lobe result in *anterior* rather than superior displacement during collapse. The septum can usually be seen as a line of density roughly paralleling the anterior chest wall on the lateral radiograph. With further diminution in the volume of the lobe, the septum approaches the anterior chest wall, eventually disappearing, as contact with the lateral parietal pleura is lost. On exceptionally well exposed lateral roentgenograms (difficult to reproduce), a faint triangular density is seen to extend from the hilum to the anterior chest wall. This shadow, the "mediastinal wedge," represents the lobe, flattened (almost two-dimensional) against the mediastinum and anterior chest wall, with the apex of the wedge attached at the hilum (Figs. 6 and 8A, C, D). Since the septum is no longer tangential to the x-ray beam, and since the thinnest portion of the lobe is perpendicular to it, the shadow is poorly defined. In the postero-anterior radiograph the collapsed lobe is seen as a shadow of paracardiac density, fading laterally (Figs. 7A, B, C, and D). Figure 6 illustrates diagrammatically collapse of the left upper lobe as seen in the lateral view. Figures 7 and 8 illustrate the postero-anterior and lateral radiographic appearance of the left upper lobe

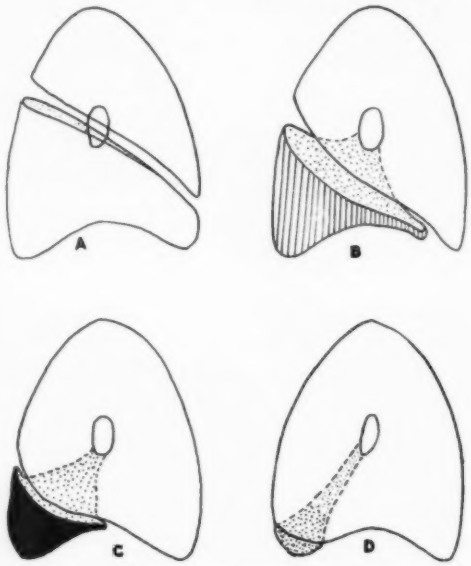

Fig. 11. Schematic representation of progressive collapse of left lower lobe as seen in the lateral projection. Mirror image would represent right lower lobe.

A. At inception of collapse.

B. Additional collapse. Septum moving towards posterior costophrenic sinus. Cross-hatching represents portion against lateral and posterior chest wall. Dotted portion represents "mediastinal wedge" and hilar attachment.

C. Further collapse. Portion against lateral and posterior chest wall represented by black area.

D. Practically complete collapse. Septum is no longer tangential to central ray and contact with lateral chest wall has been lost. Only the "mediastinal wedge" remains.

in various stages of collapse. The use of a triangular piece of paper to simulate left upper lobe collapse and to demonstrate the movement of the interlobar septum is shown in Figure 10.

To this point the description of left upper lobe collapse has been based on the assumption that the initial obstruction was in the lobar bronchus, that the collapse was progressive, and that all parts of the

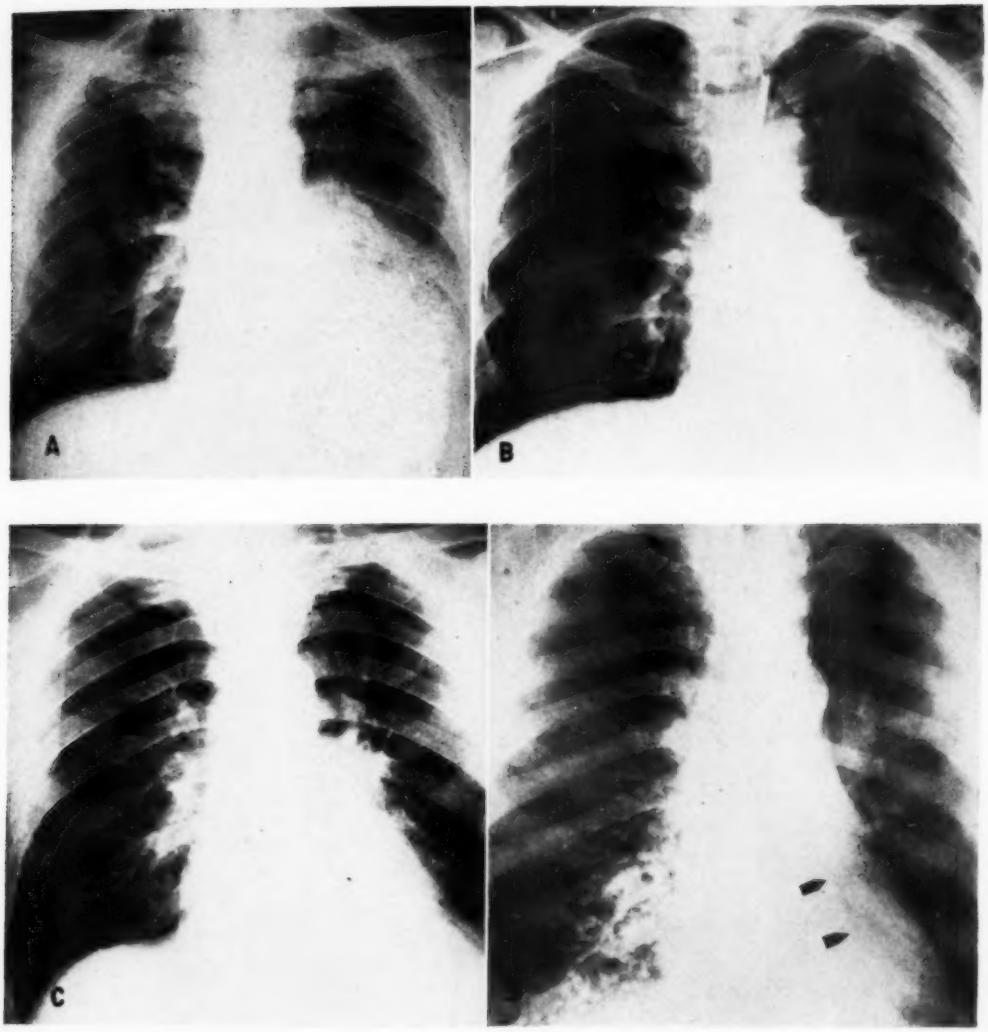

Fig. 12. Postero-anterior views of four cases illustrating progressive collapse of left lower lobe. For lateral views of these cases see Fig. 13, with same alphabetical designation.

A. Slight collapse of left lower lobe. Large part of the lobe extends beyond the heart border, which is faintly seen within the shadow of the collapsed lobe.

B. Greater collapse. Left lower lobe still extends to a point just beyond the heart border. Heart shifted to left.

C. Further collapse. The heart border approximates the lateral border of the collapsing lobe.

D. Almost complete collapse. The lateral border of the collapsed lobe (black arrows) is well within the cardiac border.

lobe participated without limiting factors.

Because of its bronchial anatomy, the left upper lobe appears particularly suitable for the demonstration of atypical varieties of collapse. Involvement of the common trunk of the apical and subapical branches (Brock's terminology) may extend to include the pectoral branch and still leave the lingula free. This may result in considerable collapse before the lingula is involved. Conversely, it is possible that such obstruction may result

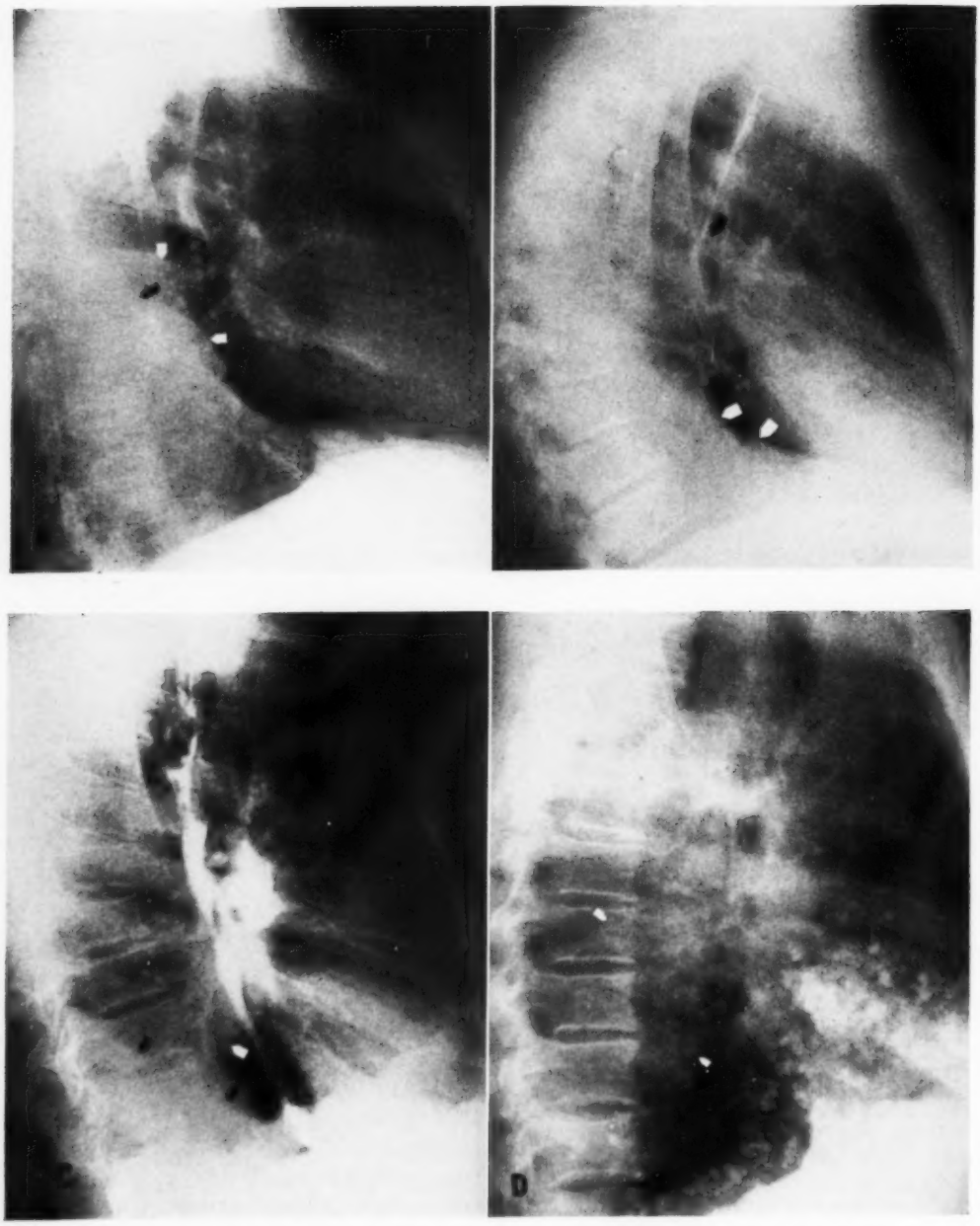

Fig. 13. Lateral radiographs of the four cases shown in Fig. 12, with the same alphabetical designation.
A. Slight collapse. Septum indicated by black arrows. White arrows show poorly defined "mediastinal wedge."
B. Further collapse. The contact with the lateral chest wall is smaller, lower, and more posterior. White arrows indicate the lower border of the septum and black arrows, the "mediastinal wedge."
C. Collapse more complete. Black arrows indicate the septum. White arrow shows the lower border of the "mediastinal wedge." The portion of the lobe in contact with the lateral chest wall is very small.
D. Only the "mediastinal wedge" is seen (white arrows). The collapsed lobe is no longer in contact with the lateral chest wall. Dense shadows anteriorly represent residual radiopaque oil. See Figs. 11D and 14D.
A, B, and C illustrate prominent triangle which grows smaller and denser with collapse. D illustrates indistinct mediastinal triangle which becomes more distinct as first or more prominent triangle disappears.

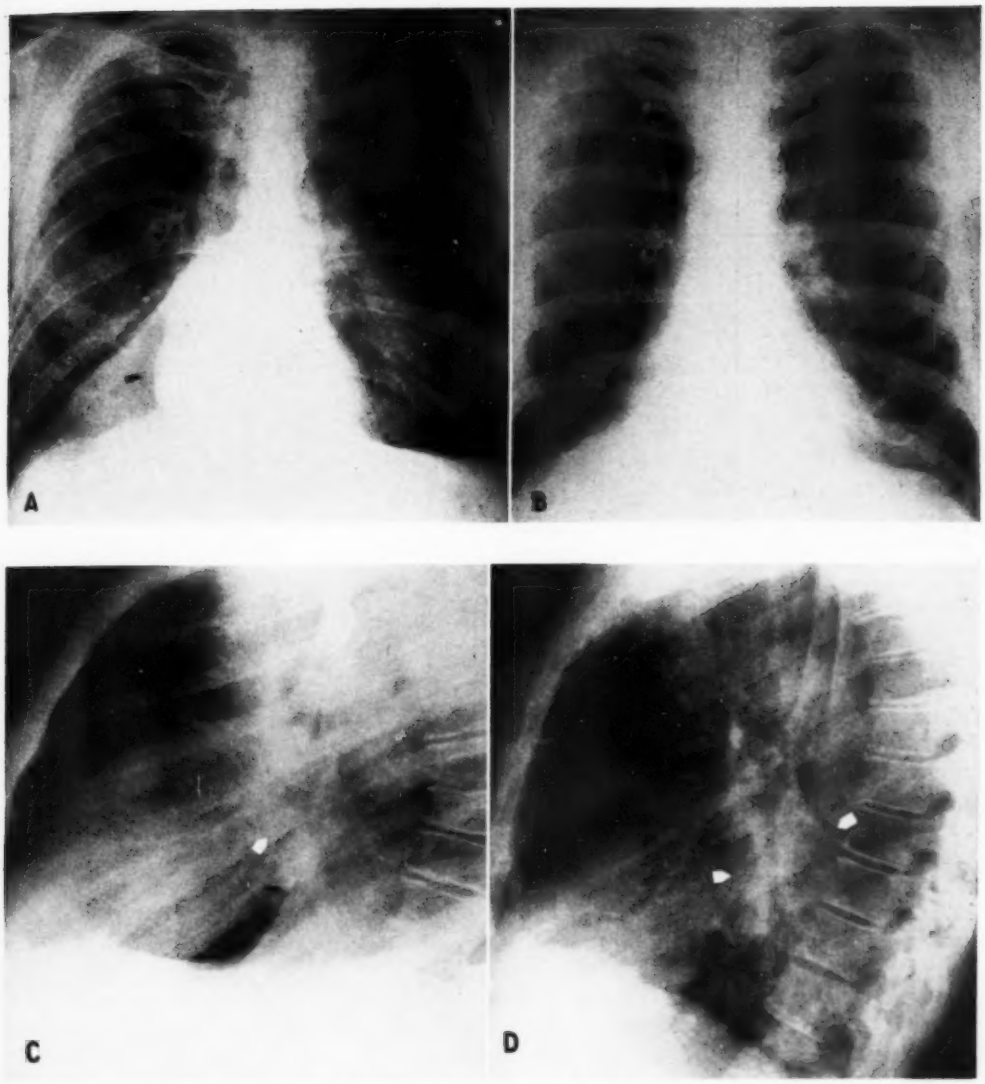

Fig. 14. Two cases of right lower lobe collapse showing similarity to collapse of left lower lobe. Compare with Figs. 11, 12, and 13.

A. Postero-anterior view shows right paracardiac density. Medial arrow points to cardiac border, lateral arrow to interlobar septum.

B. Postero-anterior view showing more collapse. Shadow of right lower lobe merged with right cardiac border. Horizontal septum retracted downward.

C. Lateral view of "A" shows posterior density. Black arrows indicate lower border of interlobar septum. White arrow points to inferior border of the "mediastinal wedge."

D. Lateral view of "B." With further collapse, only the "mediastinal wedge" is apparent (white arrows). The posterior triangle is lost as the interlobar fissure is no longer in contact with lateral chest wall. Compare with Figs. 11D and 13D.

in infection and perhaps in pleural adhesions which may "fix" the involved upper segments. When the lingular bronchi are finally occluded, that segment may collapse more than the others, since it is free of these complications.

Figure 9 presents several examples of atypical collapse.

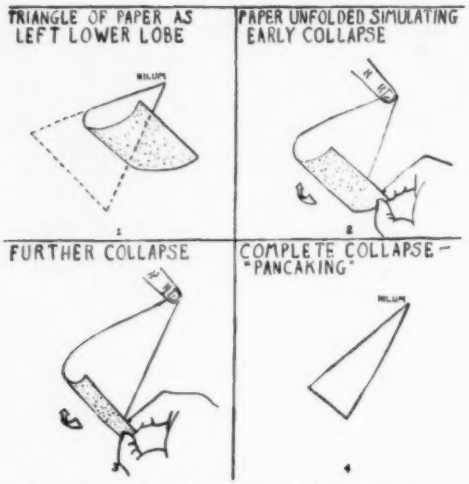
TRIANGLE OF PAPER AS LEFT LOWER LOBE
PAPER UNFOLDED SIMULATING EARLY COLLAPSE
FURTHER COLLAPSE
COMPLETE COLLAPSE - "PANCAKING"

Fig. 15. Flattened left lower lobe represented as a triangle of paper bent upon itself. The base of the triangle represents the position of the interlobar septum as it moves along the curved course of the parietal pleura, *downward* and *posteriorly*, until contact with the lateral wall is lost. At that point, only the "mediastinal wedge" remains.

THE LOWER LOBES

The mechanism of collapse in the lower lobes is exactly the same as in the upper lobes, differing only in the direction of movement of the collapsing lobe and interlobar septum. The lower lobes will be considered together.

As a lower lobe collapses, it flattens against the mediastinal, posterior, and lateral parietal pleura. At first the long septum is in contact with the lateral chest wall, but it moves posteriorly, away from the hilum (as seen in the lateral view) and toward the posterior costophrenic sinus. The resulting appearance in the lateral view is that of two triangles, superimposed on each other. The less distinct of the two triangles is the "mediastinal wedge," which has its apex at the hilum and its base against the posterior parietal and diaphragmatic pleura. The more clearly delineated of the two triangles has its apex at the costophrenic angle. The base is the interlobar septum, lying somewhere between the hilum and the costophrenic angle. The base of this triangle obscures the mediastinal wedge (Figs. 11, 13, and 14C).

As collapse continues, the interlobar septum continues to move posteriorly. The posterior, more distinct triangle, becomes denser and smaller (Figs. 11A, B, C; 13A, B, C; 14C). When the septum loses contact with the lateral chest wall, only the less distinct triangle (the mediastinal wedge) remains (see Figs. 11D, 13D, and 14D). The lobe is then completely flattened against the postero-inferior mediastinum.

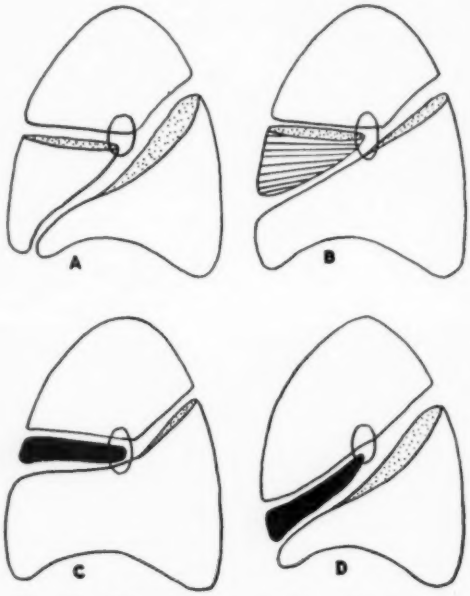

Fig. 16. Schematic representation of progressive collapse of the right middle lobe as seen in the lateral view.

A. At the inception of collapse.

B. Further collapse, with little change in position of the horizontal septum. The lower lobe is overexpanding.

C. More complete collapse. In this form the lower lobe has undergone complementary emphysema. The upper lobe is unchanged.

D. Variant of C. The middle lobe is contracted and is displaced downward. The upper lobe is emphysematous and the lower lobe relatively unchanged.

When the upper lobe is unable to participate uniformly in the complementary emphysema, the direction of the shift of the interlobar septum may vary somewhat. Thus the septum may become more vertical or more horizontal than usual, but the general pattern is not significantly changed.

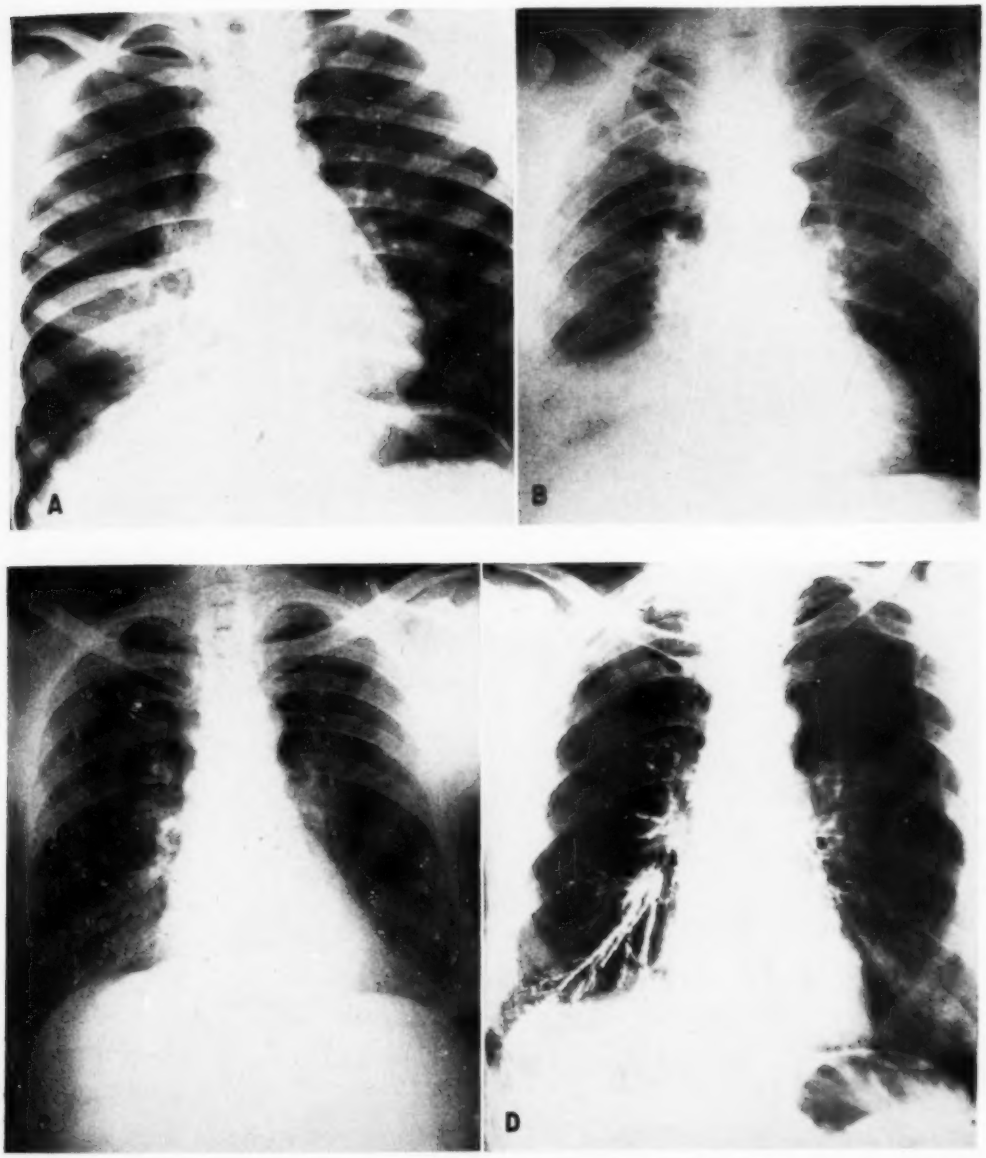

Fig. 17. Postero-anterior views of four cases illustrating collapse of the right middle lobe. For lateral views see Fig. 18, in which these cases bear the same alphabetical designation.
A. Early collapse. Very little displacement of the short septum.
B. Progression of collapse. The lobe is lower in position than normal, but the short septum is still horizontal.
C. Further collapse. Some haze medially, but a definite middle lobe is not identifiable.
D. No definite middle lobe shadow can be seen. The middle lobe bronchi could not be filled. Branches of apical bronchus of lower lobe should not be taken for middle lobe branches.

The use of a triangular piece of paper, bent upon itself, will illustrate the two triangles described and will demonstrate the shift of the septum (Fig. 15).

THE MIDDLE LOBE

The middle lobe has significantly less contact with the lateral parietal pleura than the other lobes. In collapse, the lobe

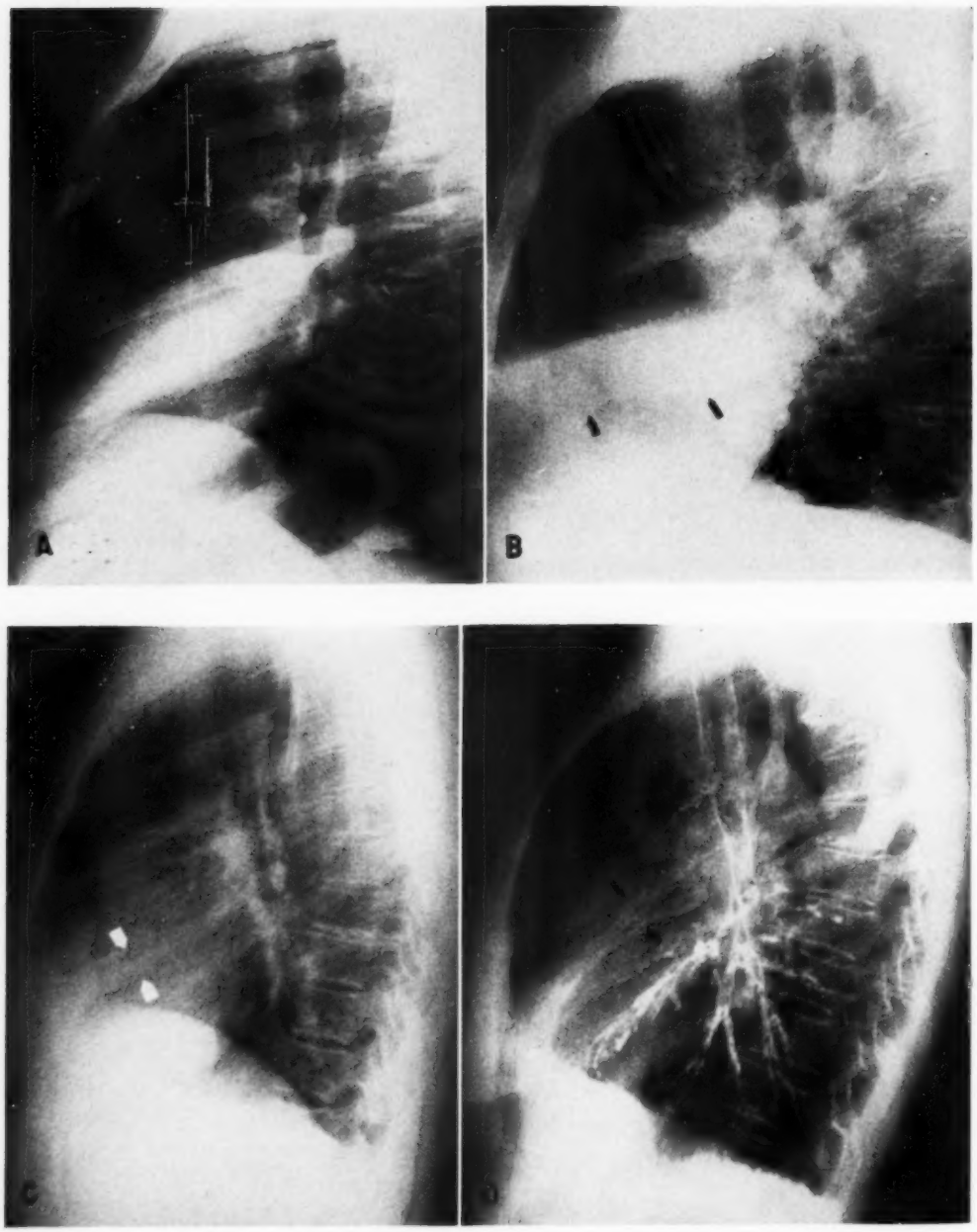

Fig. 18. Lateral radiographs of the four cases shown in Fig. 17, in the same order, illustrating middle lobe collapse.

A. Early collapse. Short septum shows relatively little displacement; posterior portion still horizontal.

B. Further collapse. Lobe less rounded. Short septum more oblique. Inferior portion of long septum retracted upward (arrows). Pneumonitis in anterior basal segment of lower lobe.

C. Further progression. Lobe (arrows) flattened in slightly oblique direction.

D. Almost complete collapse. The lobe is quite thin, in a markedly oblique direction. Middle lobe bronchi not filled. Note that branches of the apical bronchus, which simulated middle lobe branches in the postero-anterior view, are far posterior.

flattens against the mediastinal and anterior parietal pleura. As a result of its intermediary position, two septa can be seen in the lateral view. In the postero-anterior position, only the horizontal septum can be seen, but it is frequently displaced by collapse.

In the lateral view, the middle lobe is a sharply circumscribed triangle with the apex at the hilum. As collapse continues, the sides of the triangle approach each other and the apical angle becomes smaller, until in complete collapse the septa practically touch. Contact with the anterior chest wall is maintained until the end (Fig. 16).

In the postero-anterior view the middle lobe also appears to be triangular, but the apex is at the lateral chest wall. The inferior border is usually indistinct. Occasionally, however, the inferior lateral portion of the long septum may reach the anterior chest wall just superior and medial to the costophrenic angle. In such an instance the inferior lateral border of the middle lobe will be relatively well defined. With progressive collapse, the triangular appearance may be lost as soon as the short septum loses its horizontal position. In such instances, all that may be seen in the postero-anterior projection is a vaguely defined density in the lower medial lung field (Fig. 17C). Indeed, no abnormal density may be seen in the postero-anterior view (Fig. 17D). An anteroposterior lordotic projection may reveal the triangular appearance of the lobe. A routine lateral view is simpler, however, and will prevent a complete mistake in diagnosis (Figs. 18C and D).

Figures 16 to 18 illustrate the pattern of middle lobe collapse.

SUMMARY

The mechanisms and roentgen patterns of lobar collapse have been discussed and illustrated by diagrams and reproductions of roentgenograms, with emphasis on the lateral view. The lobes do not merely shrink to become smaller replicas of themselves. As they become smaller they change from a three-dimensional, pyramidal or conical figure, to approach a two-dimensional triangle and flatten along the mediastinal and parietal pleura. With continuation of the collapsing force, they move along the curved surface of the chest wall toward the hilum, the direction of the movement depending on the natural configuration and position of the lobe and the presence or absence of modifying factors.

The use of a paper triangle, bent upon itself, is presented as a useful pedagogic tool to simulate the shape of lobes undergoing collapse and to illustrate, by its unfolding, the course followed by each lobe as it shrinks toward the hilum.

NOTE: Appreciation is expressed to Drs. Leo Asher and Albert Bennett for the drawings and to Mr. Robert Newhouse for the photographic reproductions.

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SUMARIO

Formas del Colapso Lobular Observadas Radiográficamente

Los mecanismos y patrones roentgenológicos del colapso lobular aparecen aquí descritos e ilustrados con diagramas y reproducciones de radiografías, haciéndose hincapié en la vista lateral. No hay mera contracción de los lóbulos para convertirse en imágenes reducidas de sí propios: a medida que se achican, se transforman de

una figura piramidal o cónica de tres dimensiones en una especie de triángulo bidimensional, aplastándose a lo largo de la pleura mediastínica y pleural. Al continuar la fuerza aplastadora, se mueven a lo largo de la cara curva de la pared torácica hacia el hilio, dependiendo la dirección del movimiento, de la configuración y posición naturales del lóbulo y de la presencia o ausencia de factores modificadores.

Debido a importantes diferencias anatómicas, el patrón del colapso muestra ciertas diferencias en los dos lóbulos superiores, por lo cual se les discute por separado. En cambio, considéranse conjuntamente ambos lóbulos inferiores, por ser semejante en ellos el patrón del colapso.

Indícase el empleo de un triángulo de papel, doblado sobre sí propio, como útil instrumento pedagógico para simular la forma de los lóbulos en vías de colapso y para ilustrar, al desplegarse, el trayecto seguido por cada lóbulo al contraerse hacia el hilio.

Evaluation of Aortography in Abdominal Diagnosis[1]

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A QUARTER OF A century has elapsed since dos Santos and his associates (1) began their work on injection of the circulation with contrast material to render the vascular structures opaque on x-ray examination. Further work by the same authors in 1931 did much to clarify the procedure (2). Many others have subsequently contributed to the advancement of the method, in respect to technic of injection, types of opaque material injected, and interpretation of the resulting roentgenograms (3–14).

Osorio (15), in 1933, confirmed dos Santos' work. Little further was accomplished until Fariñas (16), in 1941, made aortograms after surgically exposing the femoral artery in the groin, inserting a trocar into the vessel, and passing an opaque catheter through the trocar up into the abdominal aorta. The catheter could be readily visualized fluoroscopically and its level noted. In this manner it was possible to inject the circulation of any specific organ with a small amount of 70 per cent diodrast, and both fluoroscopic and roentgenographic observations could be made. Careful scrutiny of Fariñas' original films indicates that this is a valuable method for examination of the aorta and its branches, and in these days of blood vessel surgery it would not be considered too formidable an undertaking. It may have advantages, in some instances, over the blind puncture of the aorta and the rapid injection of sufficient opaque material to fill the entire aortic system at once.

Recently the translumbar approach originally used by dos Santos has again come into vogue as a result of a number of improvements which have been introduced. According to Melick and Vitt (17), well over 3,000 cases have been reported without record of a fatality which could be traced to the procedure, though some deaths have occurred a few days later from other causes.

Sufficient time has now elapsed for evaluation of the method as an aid in abdominal diagnosis. Within the last two years the translumbar procedure has been subjected to critical analysis and study, especially by Melick and Vitt and by Hartnett (18). Much of the roentgenographic material here presented is from examination of their patients.

Practically all technics previously advocated have been considered and tried for evaluation of their simplicity, safety, and effectiveness. Gradual elimination of certain undesirable features and their replacement by more efficient methods have resulted in a smoother, more effective procedure. For instance, difficulty was at first encountered in forcing sufficient opaque solution into the aorta through a narrow-gauge syringe. There is no advantage in using a large-caliber needle if the syringe is of smaller bore. By employing a force pump for injection (Hartnett), it was found possible to obtain a more even flow of opaque medium with sufficient rapidity, even with a small-caliber needle and syringe. As soon as a properly ground syringe and sufficiently large needle were available, ordinary manual injection was rapid enough for satisfactory results.

Another example of improvement in technical procedure is the addition of pressure cuffs (from blood pressure apparatus) about the thighs, inflated to 200 mm. Hg pressure, when the blood supply of the pelvic organs is to be investigated, to prevent too rapid loss of blood flow to the lower extremities.

In the matter of injection of the opaque material, it was found that a real danger

[1] Joseph Freedman Lecture presented under the auspices of the Department of Radiology of the University of Cincinnati, Cincinnati, Ohio, May 1, 1949. Accepted for publication in June 1950.

presented itself in the possibility of introduction of the full amount directly into the mesenteric artery. Dissection of numerous cadavers showed this artery almost always arising from the aorta below the twelfth thoracic vertebra, so that change of angulation of the injecting needle to enter the aorta above this point obviated the difficulty.

Movement of the needle during injection, causing extravasation of the material, has been almost completely eliminated by introduction of a short rubber connecting tube.

The modified Wagner technic, advocated by Melick and Vitt, used at present, is as follows:

PRELIMINARY PREPARATION

Food is withheld preparatory to anesthesia. A soapsuds enema is administered in the morning to cleanse the large bowel in preparation for roentgen examination. Pre-anesthetic medication—morphine and atropine—is given three-quarters of an hour before the procedure.

There should be sent to the x-ray room the necessary equipment for pentothal anesthesia; a sterile tray for arteriography, including antiseptic solution for preparation of the patient, sterile gauze sponges, drapes, towels, gloves, talc, etc.; normal saline solution; rubber tubing with suitable Luer-Lok or other adapters and stopcock attachment (rubber tubing is necessary to prevent jostling of the needle during rapid injection); a skin puncture needle; a 15-cm. No. 12 gauge, non-breakable (silver) needle with stilet (G. Pilling & Son); 20 c.c. of 70 per cent diodrast (or 80 per cent sodium iodide solution if diodrast is not available); an intravenous set (1,000 c.c. 5 per cent glucose in normal saline solution; a syringe containing 1 c.c. epinephrine solution, 1:1,000, and another syringe containing 1.5 c.c. coramine).

The patient should be placed prone on the x-ray table and an abdominal film taken to show the adequacy of the colon preparation, to determine the best centering of the film with respect to the area of diagnostic interest, and to check the roentgen technic. If the examination is to be made for the pelvic circulation or for location of the placenta, blood-pressure cuffs (inflated to 200 mm. Hg) should be adjusted on both thighs to retard the flow in the pelvis. When this film is satisfactory or necessary corrections have been made, the cassette is again loaded, and the patient is anesthetized lightly with sodium pentothal solution administered intravenously. The skin of the lower chest and back is prepared with antiseptic solution and draped.

TECHNIC OF INJECTION

With a short stout needle, the skin is punctured just below the twelfth rib four fingerbreadths to the left of the spinous processes. The 15-cm. needle is then introduced through the puncture hole and directed anteriorly, medially, and cephalad toward the body of the twelfth thoracic vertebra. When the bone is encountered, the needle is withdrawn about 2 cm. and the point directed more laterally, so as just to pass by the vertebral body (19). Vitt and Melick further recommend (personal communication):

> . . .upward angulation of the needle at least 30° so as to enter the aorta above the level of the last thoracic vertebra, missing any of the abdominal arterial branches. The stilet is then removed and the needle cautiously advanced to within a few centimeters of its hilt. The aortic wall is encountered as a resistance through which the needle snaps, imparting to the operator a sensation similar to that experienced in penetrating the dura mater during a spinal tap. Almost immediately the needle has a pulsating drip which descends as a rivulet in the shaft. In patients with hypertension, the flow is more rapid and pulsation somewhat more vigorous, but the amount of blood lost in making the necessary adjustments for injection is trivial. In some instances the needle itself may be seen to move rhythmically with each heart beat.
>
> The needle is then connected to the rubber tubing and syringe which have been previously filled with sterile saline solution. Barbotage is carried out to note the ease of flow in both directions. A trial injection of 12 c.c. saline solution within six seconds is made in order to estimate the force required. The stopcock is then closed, the syringe disconnected and filled with approximately 20 c.c. diodrast (or 12 c.c. 80 per cent sodium iodide) solution. The

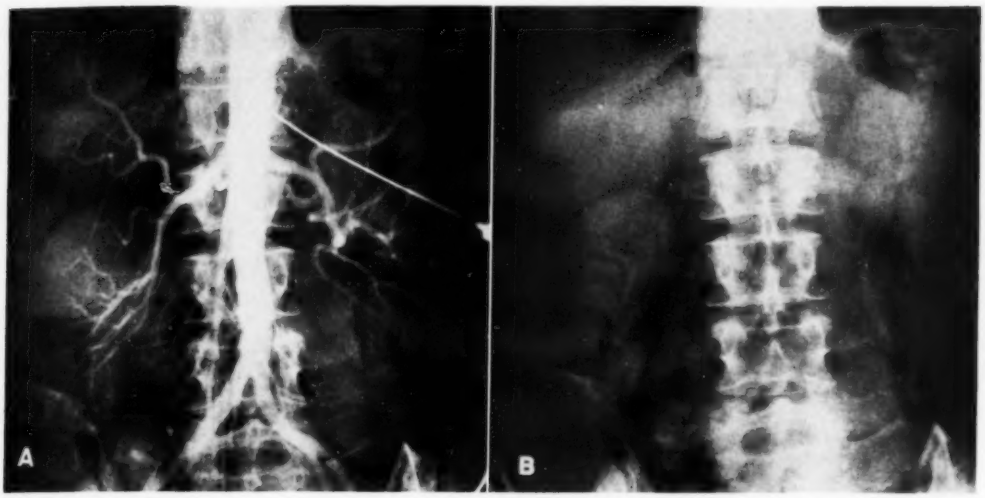

Fig. 1. A. Normal aortogram showing arterial circulation to all abdominal organs immediately after injection. B. Aortogram of same patient four seconds later, showing venous return. Note dense renal shadows (nephrograms) from opaque solution not yet washed from the kidneys.

syringe is again connected, the stopcock opened, and blood withdrawn as a final proof that the needle is well within the lumen. The signal "ready" is given to the x-ray technician, the solution injected at a rate of 2 c.c. per second, and the signal "shoot" given as the final cubic centimeter or two leave the syringe. In this roentgenogram the aorta and all abdominal tributaries should be well outlined. Immediately following exposure of the film, the needle is withdrawn.

Another exposure made two or three seconds later will demonstrate the venous return; this may be of great importance, since it may reveal any delay in passage of the blood through an organ such as the kidney, liver, or spleen. Ordinarily the kidneys are well outlined due to delay in passage of blood through their structures.

AFTER CARE

After injection, the patient usually moves slightly and breathes more deeply. During this period, oxygen is administered by the anesthetist and careful watch is kept of the patient's color, respirations, and pulse. The needle through which the pentothal was given is left in place and used for administration of 1,000 c.c. of 5 per cent glucose in normal saline solution. Within ten minutes the patient is usually conscious and has no complaints. Several hours later he is allowed his regular tray and ambulation is permitted if there are no contraindications.

CONTRAINDICATIONS

Contraindications are similar to those holding for injection of the same materials into the circulation in other procedures, such as intravenous urography, arteriography, cardioangiography, etc. Among those which have been mentioned are: advanced renal destruction with uremia, severe disease of the liver, exudative diathesis, severe hyperthyroidism, advanced tuberculosis, and iodine sensitivity. Most of these are detectable beforehand, and can thus be taken into consideration. It is not the effect of the iodine upon the diseases listed that constitutes the contraindication, since the iodine radical is so well bound in this organic compound that "it is questionable whether the temporary presence of such iodine (diodrast) which might be absorbed from the blood could have a deleterious effect on the tissues, even in the presence of an active lesion such as tuberculosis.[2] Iodine sensitivity, however, may be a potent cause of reaction even with the minute amounts of the element present in diodrast, and the effects may be most dramatic. Pendergrass, Chamberlin, Godfrey, and Burdick (20) have collected 26

[2] Editorial Comment, J. A. M. A. **114**: 347, Jan. 27, 1940.

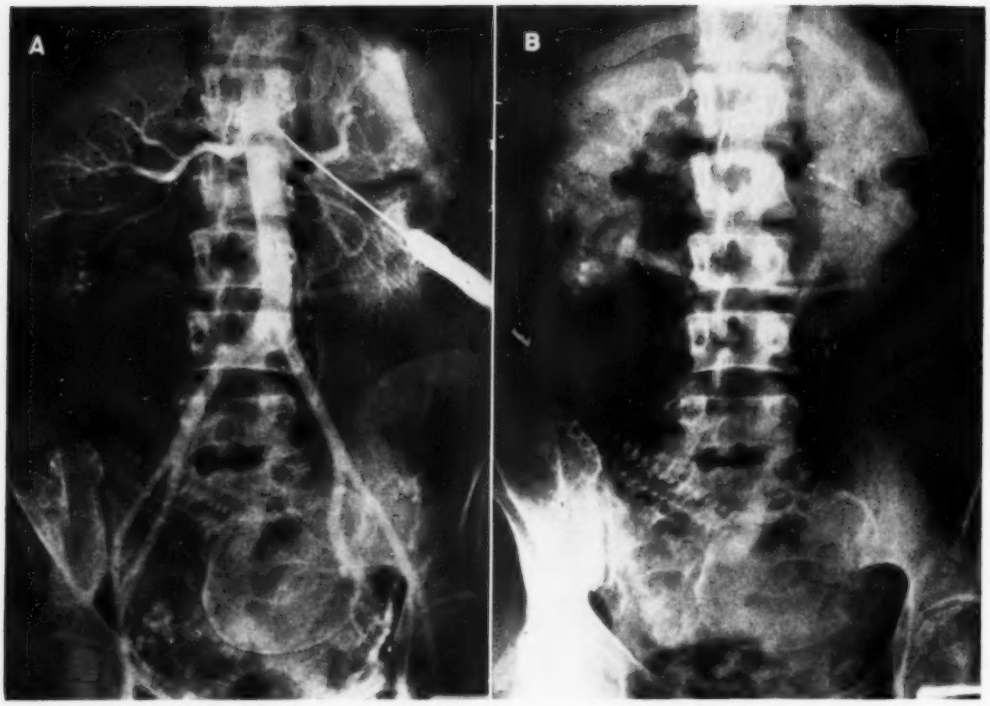

Fig. 2. A. Aortogram showing "puddling" of blood in sinusoids of the placenta, giving an irregular appearance by which it can be recognized; it is in a position of placenta praevia.
B. Four seconds later the arterial circulation has been washed clear but venous return remains delayed in sinusoids of the placenta, thus showing this structure even more clearly than on the first exposure.

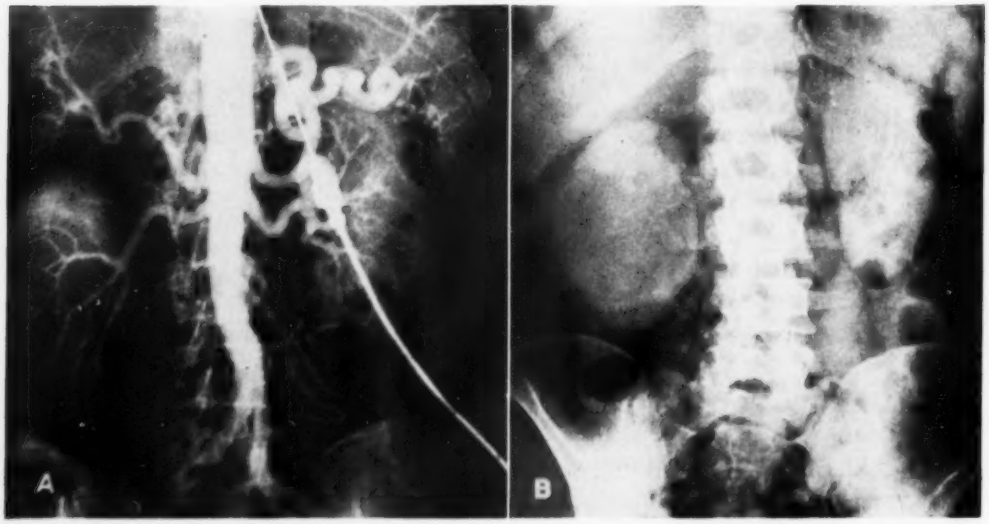

Fig. 3. A. Large rounded mass in right kidney; fine slender arterial branches indicate that it probably is a cyst.
B. Aortogram made a few seconds later, showing arterial circulation swept clear, some retention in kidneys, but no "puddling" in the mass. "Puddling" would have indicated a neoplasm.

Fig. 4. Neoplasm (hypernephroma) of left kidney, indicated by the "puddling" seen within the mass in the lower pole of the kidney. "Puddling" often shows best after the arterial injection has been swept clear.

instances of death from allergic reaction or renal damage among 661,800 roentgenographic examinations, 0.0039 per cent.

To avoid such a risk, it is well to test for iodine sensitivity before diodrast injection in every case. Robins (21) has devised a cutaneous test for this purpose. Archer and Harris (22) use an ocular test before administering any iodine-containing drug. The reaction may be prevented by prompt administration of adrenalin. Robb and Steinberg (23) test kidney function first. If the patient gives a history of allergy, adrenalin and pitressin are used immediately without waiting for symptoms to appear.

EVALUATION OF THE METHOD

An ordinary flat film of the abdomen can be expected to yield information as to the size, location, form, and outline of the various abdominal organs. Sizable tumors may be detected and their proximity or attachments to various viscera noted. Information is also furnished as to gas distention of the bowel in determination of intestinal obstruction or paralytic ileus. Gastro-intestinal examination will demonstrate the presence of intrinsic lesions and will show the relationship of other abdominal organs and masses to the stomach and intestines. Pyelography, both retrograde and intravenous, has brought about a high degree of diagnostic efficiency in the field of urology.

None of these methods, however, will give any idea as to the source, distribution, and character of the blood supply to an organ or tumor. Aortography provides the means by which this can be done. Its prime object is directed to the demonstration of the blood supply to abdominal

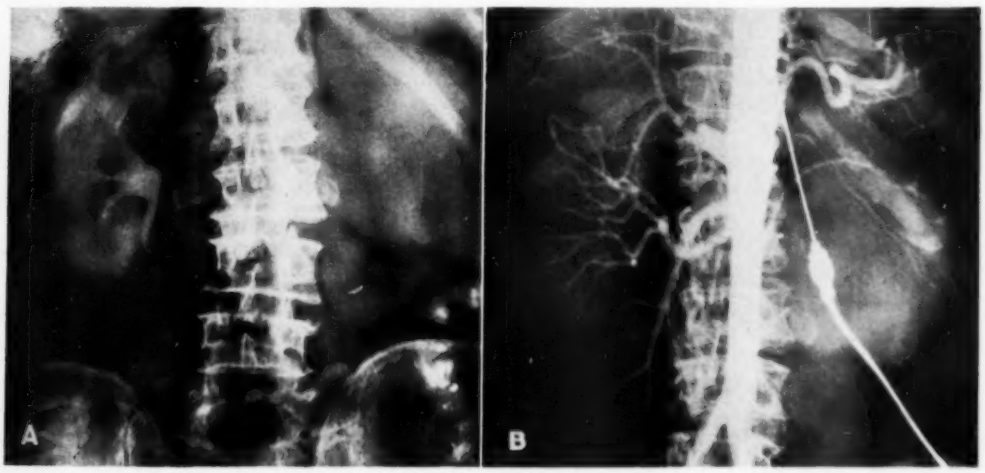

Fig. 5. A. Intravenous pyelogram of non-functioning left kidney, with large hydronephrosis. Right side normal.

B. Aortogram of same patient, showing good blood supply to right kidney but almost complete avascularization of left kidney, indicating that conservative measures will be of no avail in salvaging the diseased kidney.

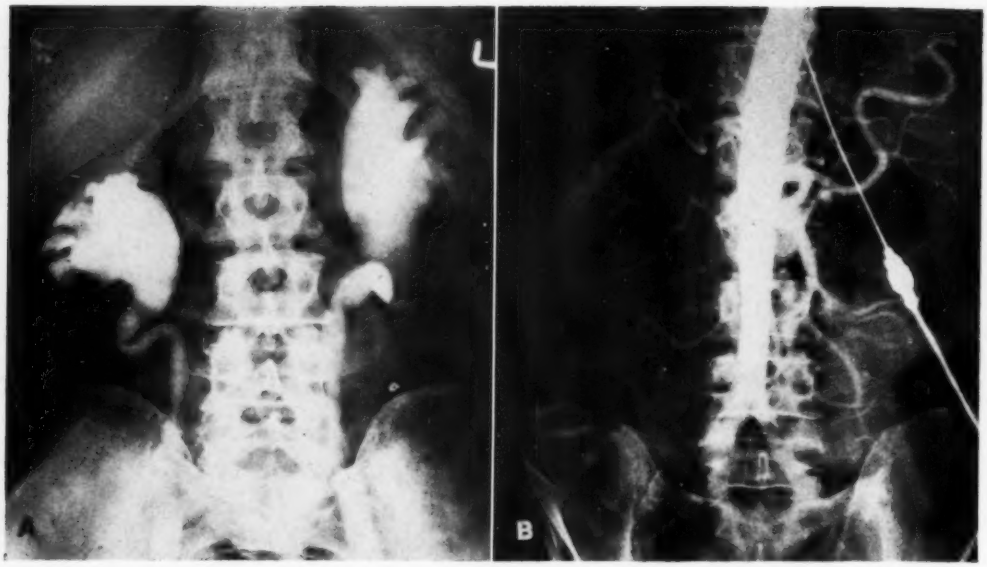

Fig. 6. A. Bilateral hydronephrotic kidneys showing enlargement of pelves and ureters, with pressure from pelvic dilatation.
B. Aortogram showing scant blood supply to kidneys, almost to the point of ischemia.

organs and evaluation of its quantity, character, and distribution. It is evident that variation from the normal vascular pattern is the means by which various pathological conditions can be recognized.

Variation in the size of the vessels supplying an organ becomes a matter of judgment and, unless actual dilatation or constriction of the vessels is extreme, it may be very difficult to evaluate any change.

Supernumerary vessels, however, can usually be readily detected and appraised, as for instance an additional artery to the upper pole of the kidney, as in the presence of a double kidney pelvis, fused kidneys, or other developmental anomalies. An aberrant vessel to an otherwise normal kidney can usually be identified, thus presenting a clearer understanding of pressure effects on the kidney pelvis as seen in the pyelogram.

Variations in distribution of the arterial supply to some part of an organ may signify a structural change, such as a cyst, neoplasm, or parenchymal destruction; avascularization may mean necrosis or atrophy from chronic pressure from a large hydronephrosis. Variation in the vascular pattern of such lesions of the kidney may aid in their identification and differentiation.

Large solitary cysts of the kidney show a *decrease in vascular supply* with fine scanty vascular structures widely divergent over the surface of the expanding cyst, since the blood vessels are in the capsule and not in the center of the tumor.

Neoplasms of the kidney, on the other hand, due to their extreme vascularity, may show *"puddling"* or *"laking" of the circulation* within the tumor, which is quite characteristic when encountered. This appearance of "puddling" of the circulation may not be clearly evident on immediate injection; within a few seconds, however, on second examination, the larger vessels are swept clear by the blood stream and the "puddling" becomes more apparent due to the sluggishness and retardation of the blood flow as it passes through the tumor. Even a small parenchymal tumor can be detected by this means though the pyelographic examination may not have disclosed its presence as a source of hemorrhage.

An extreme example of "puddling" is

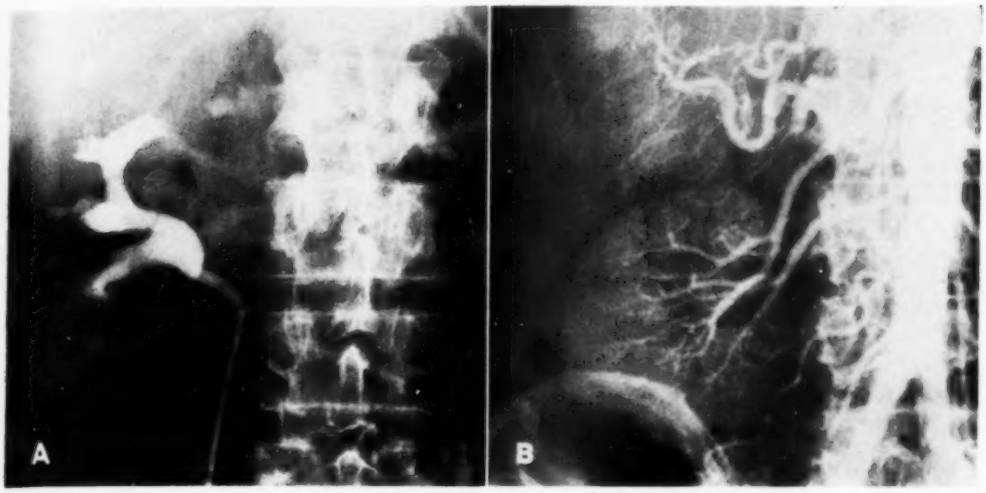

Fig. 7. A. Partial blockage of the kidney pelvis at the ureteropelvic junction may be due to an aberrant renal vessel.
B. Aortography discloses readily the origin, size and distribution of such an aberrant vessel.

seen in the *placenta*. With passage of the initial arterial stream, the "puddling" caused by retardation of the circulation as it passes through the sinusoids is very clearly shown, locating the *placental site*. In the *detection of placenta praevia* this is a most helpful method. The liver circulation shows a somewhat similar appearance. At times, "puddling" may not be evident in a kidney tumor but, if detected, it is diagnostic.

Actual *cortical necrosis*, on the other hand, from whatever cause, will show complete avascularity of the area involved.

Pressure atrophy of the entire kidney parenchyma from a large hydronephrosis may cause almost complete avascularization of the kidney. Pressure of the enormously distended pelvis structure upon the circulation may result in cutting off of the primary blood supply.

All of the conditions mentioned above produce large rounded masses involving the kidney structure. It is obvious, then, that aortography may be of great aid in their differentiation.

Inadvertent injection of the highly concentrated contrast solution directly into the renal circulation results in an increase in density of the entire kidney, due to retained opaque material—very much like a nephrogram produced following intravenous injection of diodrast for urography, where there is retention of the solution in the tubules from ureteral obstruction. Failure of a portion of the kidney to show this increased density in such a case indicates that it is either supplied by another vessel or is entirely avascular.

PRACTICAL CLINICAL APPLICATIONS

Applying the principles discussed above, it is evident that aortography is of value under the following conditions:

1. In renal anomalies to determine the presence of an adequate blood supply before any operative procedure is instituted; for example, in differentiation of ptosis of kidney and true ectopic kidney, to determine if the renal pedicle is long enough to permit operative elevation; in horseshoe kidney to determine the feasibility of severance and suspension by showing the length of vessels and their character.

2. In differentiation of a large renal neoplasm from a cyst. The neoplasm shows vascularity throughout, with "laking" of the blood supply within the tumor, while the cyst has thin, widely divergent blood vessels at the periphery with an avascular

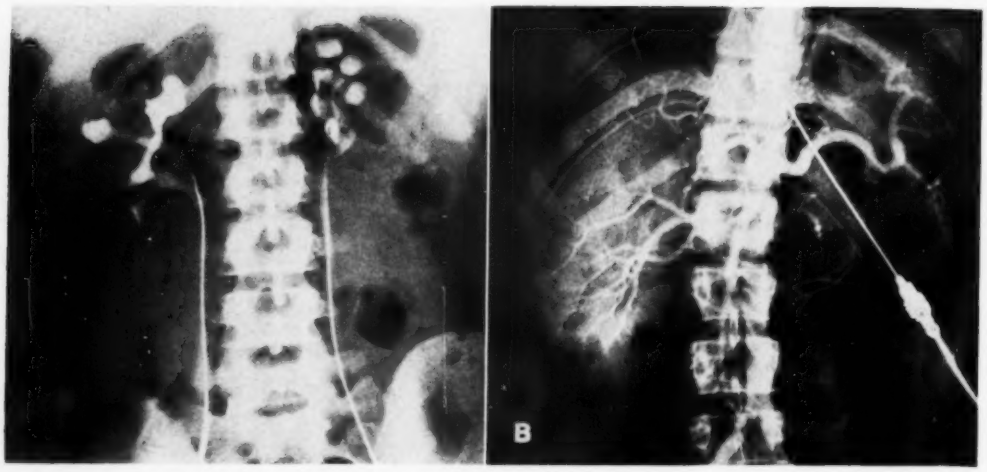

Fig. 8. A. Double kidney pelves, with or without associated complete duplication of the ureters, often receive their blood supply from two separate arteries.
B. Aortography discloses readily the presence and distribution of such vascular structures.

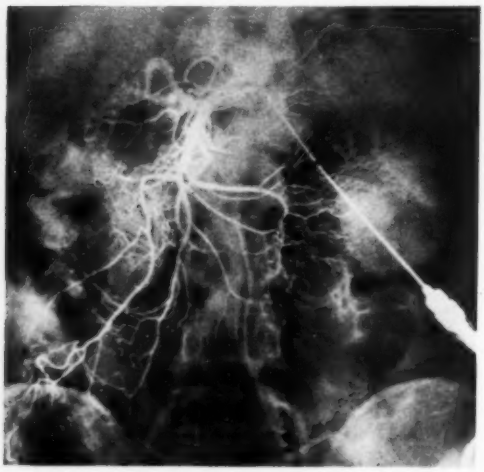

Fig. 9. Aortogram after direct injection of full dose of opaque material into the mesenteric artery. This may result in gangrene of the bowel. To avoid such mishaps, injection is now made at a higher thoracic level, well above the origin of the mesenteric artery.

center. The procedure also aids in determining the operability of tumors.

3. In enormous hydronephrosis of long standing, in which renal function is much reduced, to determine whether conservative treatment may be of value in rehabilitating the kidney or whether immediate operative removal is indicated. If the condition has advanced to the point of extreme interference with the blood supply, the kidney may better be removed at once, since it probably will never regain its function.

4. In hydronephrosis with pronounced enlargement of the kidney pelvis, where the function is still good, to demonstrate the blood supply to the pelvis, thereby assisting the urologist in its plastic reconstruction.

5. In cases of ureteral blockage with resulting non-functioning kidney, where the pelvis cannot be filled either by retrograde injection or by the intravenous method, to assure that there is adequate blood supply to the kidney.

6. In renal hematuria where there is pyelographic deformity from a blood clot. Usually such a defect will disappear or change at subsequent examination, but if immediate operation is necessary, aortography may disclose the tumor.

7. In renal hematuria where the pyelogram appears normal. Here aortography *may* show a small renal cortical tumor which could not be demonstrated otherwise.

8. In vascular hypertension, for demonstration of ischemia of the renal circulation.

9. In pregnant women, in whom it will demonstrate clearly the site of the placenta because of the "puddling" of the circula-

tion. It will also provide absolute indication of the existence of placenta praevia.

10. In neurological conditions to show the level of block in arteries of the lower extremities and pelvis.

SUMMARY

The technic of translumbar aortography is described and an evaluation of the method is presented. By demonstrating the quantity, character, and distribution of the blood supply to the abdominal organs, this procedure makes possible the recognition and differentiation of various pathological conditions, notably renal cysts and neoplasms, placenta praevia, and ischemia of the renal circulation.

In the presence of renal anomalies and hydronephrosis, aortography, by demonstrating the adequacy of the blood supply, furnishes a valuable guide to treatment.

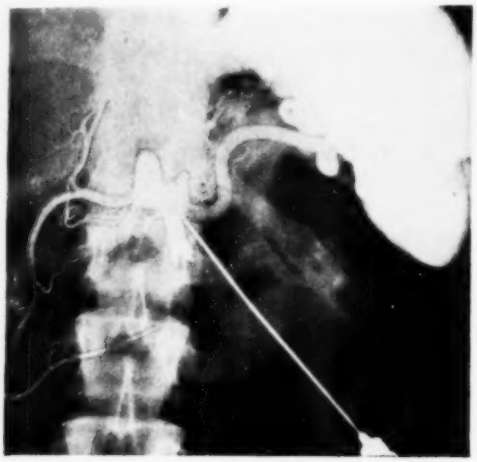

Fig. 10. Direct injection of the full amount of contrast material into the splenic artery, showing extreme density of spleen. No harmful effects.

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Fig. 11. Direct injection into the renal artery, showing extreme density of all but lower pole of the kidney. This indicates that the lower pole is probably supplied by another vessel. Patient was followed for almost a year without any evidence of injury to the kidney.

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SUMARIO

Justipreciación de la Aortografía en el Diagnóstico Abdominal

Después de describir la técnica de la aortografía translumbar, ofrecése una justipreciación del método. Por demostrar la cantidad, naturaleza y distribución del riego sanguineo en los órganos abdominales, dicho procedimiento permite reconocer y diferenciar varios estados patológicos, y en particular los quistes y las neoplasias renales.

Una neoplasia revela vascularidad por todas sus partes, con "laqueación" de la sangre en el interior, mientras que un quiste muestra escasa vascularización, con vasos sanguíneos ampliamente separados en la periferia, y centro avascular. La "laqueación" o "empozamiento" es también típica de la circulación placentaria y sirve para localizar la placenta y para reconocer la placenta previa.

En presencia de anomalías renales e hidronefrosis, la aortografía, por demostrar la suficiencia del riego sanguíneo, aporta además una guía valiosa para el tratamiento.

Radiation Therapy of Carcinoma of the Vagina[1]

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In 1935 Taussig made the defeatist statement: "We acknowledge our total inability to do anything effective for primary cancer of the vagina," and as late as 1947 McIlrath in a review of the literature on carcinoma of the vagina summarized: "Primary carcinoma of the vagina is acknowledged to be a rare and usually fatal disease.... All authors agree that primary vaginal carcinoma is difficult to treat." This seems indeed to reflect a quite prevalent opinion. Yet results of the Institut du Radium as presented by Courtial in 1938 demonstrate that the prognosis in cases treated by adequate radiation therapy compares favorably with that of cancer of the cervix with comparable extension of the disease. Our own observations are in agreement with this conclusion. It is the purpose of the following discussion to evaluate the results of treatment in relation to the biological and clinical peculiarities of vaginal carcinoma and to the technics used.

It is essential to differentiate clearly between primary carcinoma of the vagina and carcinoma of the cervix extending into the vagina. We classify a lesion as a carcinoma of the vagina when on clinical examination the cervix is found intact or when a slight cervical involvement disappears rapidly after radiological treatment while the main part of the tumor is still present in the vagina. In cases in which the cervix cannot be adequately examined prior to treatment, the final diagnosis must be postponed.

Carcinoma of the vagina is rare. The proportion of vaginal carcinoma to carcinoma of the cervix is about 1:50, or 2 per cent (Courtial, Way). Since 1933, 485 carcinomas of the cervix have been seen in our institution. During the same time we have observed 10 carcinomas of the vagina. Statistical evaluation of results is therefore not possible. It is particularly difficult to reach conclusions regarding curability from reports in the literature because in many instances it is impossible to judge clearly the extension of the disease in the treated cases.

Table I: Carcinoma of Vagina: Results.

Stage	I			II			III		
Institut du Radium, 1919–35									
Technic	No.	Well 3 yr.	Well 5 yr.	No.	Well 3 yr.	Well 5 yr.	No.	Well 3 yr.	Well 5 yr.
Intracavitary radium	2		2	1	0				
Intracavitary radium and roentgen therapy or teleradium	3	2	1	10	3	4	8		1
Roentgen therapy or teleradium only				4	1	2	3	0	
Total	5	5		15	10		11	1	
Tumor Institute, Swedish Hospital, 1939–46									
Roentgen therapy and intracavitary radium	3	2		6	4		1*	0	

* This case was treated by x-rays only and treatment was not completed, because of the patient's general condition (syphilis and tuberculosis).

For evaluation and comparison of results, it is necessary to agree to a certain staging. A clinically useful classification was proposed by Courtial, analogous to the staging of carcinoma of the cervix. He differentiates three stages:

Stage I: Nodular tumor or flat ulceration, in surface area involving not more

[1] From the Tumor Institute of the Swedish Hospital, Seattle, Wash. Accepted for publication in July 1950.

TABLE II: CARCINOMA OF VAGINA

Roentgen therapy: 200 kv., 2 mm. Cu, h.v.l. 1.70 mm. Cu; 800 kv., 4.5 mm. Pb, h.v.l. 9.1 mm. Cu. Radium therapy: Manchester type vaginal ovoids: S. Small ovoid, 2 cm. diameter. M. Medium ovoid, 2.5 cm. diameter. L. Large ovoid, 3.0 cm. diameter. Radium tubes of 1.5 cm. active length, filtration 1.0 mm. Pb. Radium dosage calculations from published tables of Paterson-Parker and Edith Quimby.

	Case 1 M. R., Age 66 1943	Case 2 E. L., Age 35 1944	Case 3 L. O., Age 67 1945	Case 4 L. C., Age 37 1945	Case 5 M. K., Age 47 1945
History	Hysterectomy 25 yr. earlier. White discharge, 3 mo.; spotting on 3 occasions	Brownish discharge 5 mo. Cervical cauterization 10 mo. earlier	Slight vaginal hemorrhage 5 wk. Bearing - down sensation 6 wk.	Pink discharge 3 mo.	Continuous bloody discharge 4 wk.
Pelvic findings	Hard induration, 6 cm., in middle anterior wall, with central crater	Indurated plaque, 3 cm., in posterior wall	Extensive infiltration of posterior wall and rectovaginal septum. Large ulcer, entire posterior wall	Ulceration, upper half of left lateral wall. Paravaginal infiltration	Ulcerated induration in right fornix
A. P. pelvic diameter	19 cm.	25 cm.	20 cm.	19 cm.	20 cm.
Histology	Epidermoid III	Epidermoid III	Epidermoid III	Epidermoid III	Epidermoid III
Clinical stage	II	I	II	II	I
ROENTGEN THERAPY: Kv.	200	800	800	800	800
ROENTGEN THERAPY: Fields: number and size	6 10×12 cm.	4 10×14 cm.	4 10×14 cm.	4 10×14 cm.	4 10×14 cm.
ROENTGEN THERAPY: r/skin per field	2,400 r 4 fields 1,500 r 2 fields	3,300 r	3,500 r	2,500 r 2 fields 4,000 r 2 fields	2,800 r 2 fields 3,500 r 2 fields
ROENTGEN THERAPY: Total skin dose	12,600 r	13,200 r	14,000 r	13,000 r	12,600 r
ROENTGEN THERAPY: Duration of treatment	42 days	53 days	48 days	44 days	59 days
ROENTGEN THERAPY: Estimated dose at central axis of vagina by X-rays	3,800 r	4,600 r	7,000 r	6,500 r	6,300 r
RADIUM THERAPY: Mg. hr.	3,000	3,760	1,500	2,500	4,000 2,400 4,500
RADIUM THERAPY: Estimated max. dose on vaginal wall	8,000 r	6,400 r	4,000 r	10,000 r	15,000 r
RADIUM THERAPY: Hr.	75	94	50	100	100 100 112
RADIUM THERAPY: Applicator	2 M. ovoids in tandem	2 L. ovoids in tandem	2 M. ovoids in tandem	1 M. ovoid	2 M. ovoids 2 M. ovoids Cervical tandem
RADIUM THERAPY: Charge	2 × 20 mg.	2 × 20 mg.	2 × 15 mg.	25 mg.	2 × 20 mg. 15/10 40
Sequence*	1-2	2-1	1-2	1-2	2-2-2-1
Remarks	.....	.....	.....	Emphasis on left side	Emphasis on right side
Results	Well 6½ yr.	Well 5 yr.	Well 4½ yr.	Well 4 yr.	Well 4 yr.

* Sequence: 1. Roentgen therapy. 2. Radium.

than one-half of either anterior or posterior vaginal wall, with only slight infiltration.

Stage II: Tumors with a surface area extending over more than half of the anterior or posterior vaginal wall, infiltrating paravaginal soft tissues unilaterally or bilaterally, and/or with moderate infiltration into the vesicovaginal or rectovaginal septum, but without fixation to pelvic bone and without demonstrable infiltration into the rectal (proctoscopy) or bladder mucosa (cystoscopy). The annular stenosing forms are included in this group.

Stage III: Tumors with infiltration,

TABLE II: CARCINOMA OF VAGINA.—*cont.*

Roentgen therapy: 200 kv., 2 mm. Cu, h.v.l. 1.70 mm. Cu; 800 kv., 4.5 mm. Pb, h.v.l. 9.1 mm. Cu. Radium therapy: Manchester type vaginal ovoids: S. Small ovoid, 2 cm. diameter. M. Medium ovoid, 2.5 cm. diameter. L. Large ovoid, 3.0 cm. diameter. Radium tubes of 1.5 cm. active length, filtration 1.0 mm. Pb. Radium dosage calculations from published tables of Paterson-Parker and Edith Quimby.

	Case 6 J. N., Age 63 1946	Case 7 C. P., Age 57 1942	Case 8 E. B., Age 28 1942	Case 9 E. J., Age 73 1945	Case 10 M. P., Age 59 1946
History	Hysterectomy 14 yr. earlier. Discharge 5 mo. (1 mo. bloody)	Menopause 10 yr. Occasional bloody discharge 2 yr.	Tumor accidentally found at examination for sterility	Watery discharge 2 yr., at times brownish	Menopause 9 yr. Spotting 3 wk.
Pelvic findings	Induration, 3 cm., in posterior wall and vault	Induration anterior wall. Mass in cul-de-sac	Induration in middle anterior wall	Anterior and posterior vaginal wall. Two lesions, circular, at different levels	Infiltration, 3 cm., in posterior wall, with ulceration
A. P. pelvic diameter	22 cm.	18 cm.	?	?	21 cm.
Histology	Epidermoid II	Epidermoid III	Epidermoid III	Epidermoid III and leukoplakia	Epidermoid II
Clinical stage	II	III	I	II	II
ROENTGEN THERAPY: Kv.	800	200	800	800	800
ROENTGEN THERAPY: Fields: number and size	4 10×14 cm.	6 10×12 cm. 1 6×7 cm.	3 10×14 cm.	4 10×14 cm.	4 10×14 cm.
ROENTGEN THERAPY: r/skin per field	4,000 r	2,500 r 2 fields 1,800 r 2 fields 1,100 r 2 fields 1,200 r 1 field	3,400 r	3,400 r	3,400 r
ROENTGEN THERAPY: Total skin dose	16,000 r	12,000 r	10,200 r	13,600 r	13,600 r
ROENTGEN THERAPY: Duration of treatment	53 days	47 days	41 days	68 days	62 days
ROENTGEN THERAPY: Estimated dose at central axis of vagina by X-rays	6,800 r	.....	.....	.....	6,800 r
RADIUM THERAPY: Mg. hr.	3,810	.....	3,650 1,290	2,100 2,160	1,400
RADIUM THERAPY: Estimated max. dose on vaginal wall	10,600 r	.....	13,550 r	19,000 r	4,000 r
RADIUM THERAPY: Hr.	127	.....	91	70 72	55
RADIUM THERAPY: Applicator	2 S. ovoids	.....	2 M. ovoids 2 M. ovoids in tandem	1 S. ovoid 1 M. ovoid	1 L. ovoid
RADIUM THERAPY: Charge	2 × 15 mg.	.....	2 × 20 mg. 2 × 15 mg.	30 mg. 30 mg.	25 mg.
Sequence*	1–2	1	2–1–2	1–2–2	1–2
Remarks	.....	Treatment discontinued on account of general condition (syphilis, tuberculosis). One perineal field	Central suprapubic field	Two lesions in vagina. Radium 6 mo. post-roentgen therapy	Treatment discontinued on account of diarrhea
Results	Well 3 yr.	Died 1 yr.; locally uncontrolled	Died 1½ yr.; high pelvic metastases	Died 2 yr.; vulvar recurrence	Died 1 yr.; locally uncontrolled

* Sequence: 1. Roentgen therapy. 2. Radium.

fixed to the pelvic bone or infiltrating mucosa of urethra, bladder, or rectum, or involving the vulva. A separate induration palpable in the pelvis apart from the primary lesion will place the case in the same category even if the primary lesion is less extensive. This Stage III would correspond to Stages III and IV of cancers of the cervix.

The results of radiation therapy obtained at the Institut du Radium in 31 cases of carcinoma of the vagina are summarized in Table I. Sixteen patients were without symptoms of active disease three

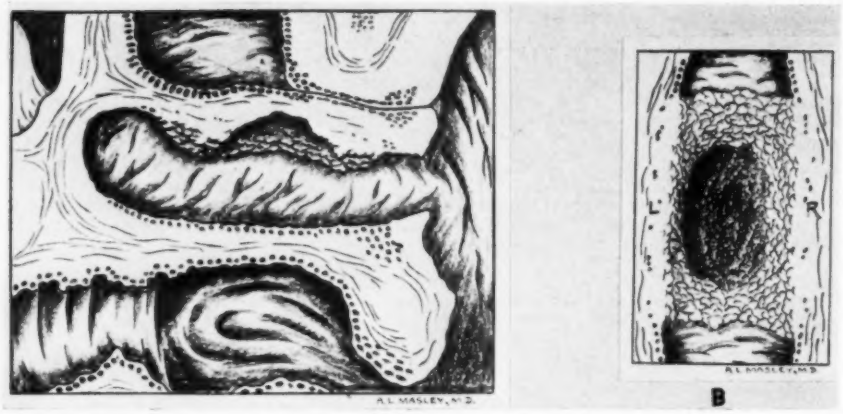

Fig. 1. Case 1: Epidermoid carcinoma, Grade III; clinical Stage II. B. Anterior vaginal wall viewed from behind. For details of history and treatment of this and other cases, see Table II.

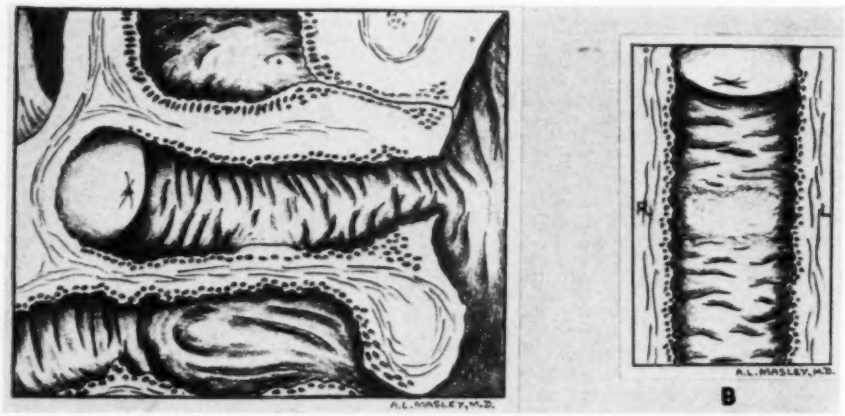

Fig. 2. Case 2: Epidermoid carcinoma, Grade III; clinical Stage I.

years or more after treatment. Of 20 patients with lesions of Stages I and II, 15 had remained well. Among the 15 failures, all but two deaths occurred within two years after treatment with uncontrolled local disease. The remaining patients (both stage III) died after four years, of liver metastases. Thus freedom from demonstrable pelvic disease after three years is probably sufficient for judging the result of treatment to the pelvis.

As can be seen from Table I, only 3 cases were treated by intracavitary radium alone. *All the other cases received either external roentgen therapy or teleradium therapy alone or in conjunction with the intracavitary radium therapy.* The technic of external irradiation was essentially the same radical procedure as is used in the Institut du Radium in the treatment of carcinoma of the cervix.

Of our own 10 patients treated since 1939, 6 are free of demonstrable disease for more than three years; 5 for more than four years (Tables I and II). Four died within two years: 1 of an extrapelvic abdominal metastatic mass with the local disease apparently controlled (Case 8); 3 with uncontrolled local disease. One of these latter (Case 7) had incomplete treatment—

Fig. 3. Case 3: Epidermoid carcinoma, Grade II; clinical Stage II.

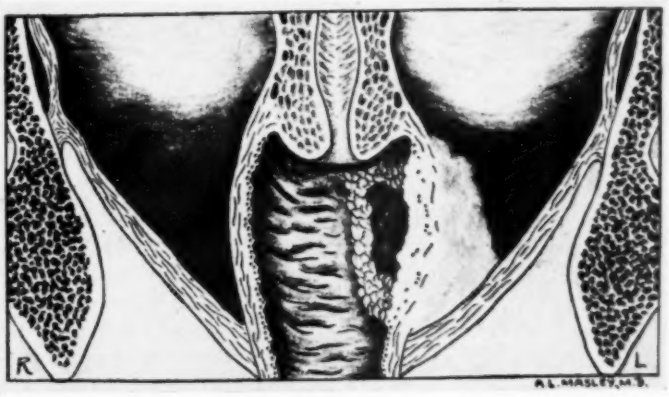

Fig. 4. Case 4: Epidermoid carcinoma, Grade III; clinical Stage II.

no local radium—because of her general condition (syphilis and tuberculosis); 1 (Case 9) received local radium treatment six months after completion of x-ray therapy for clinically manifest uncontrolled disease.

All of the 6 controlled patients received radical external roentgen therapy in conjunction with local radium application. The details are given in Table II. In contrast to the technic which we use in carcinoma of the cervix, roentgen therapy for vaginal carcinoma was given through *oblique* fields *centered toward the vagina*. When 200-kv. irradiation was used, six fields were covered; with 800-kv., four fields. The choice of the quality of radiation depended on the size of the patient, but the use of supervoltage is not essential. In all but the very early lesions (Stage I, Cases 2, 5, 8) the full course of roentgen therapy preceded the local radium application. Radium was applied by means of ovoids, as in carcinoma of the cervix, but the procedure did not follow any routine schedule. It was adjusted to location and

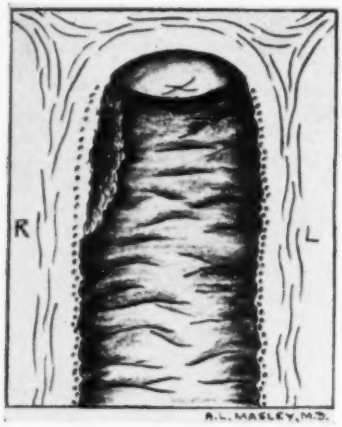

Fig. 5. Case 5: Epidermoid carcinoma, Grade III; clinical Stage I.

size of the lesion and the vagina. In no instance—even with massive involvement of the rectovaginal septum, as in Case 3—did a fistula develop. Neither did we observe any objectionable degree of early or late reaction of bladder or rectum. All 6 patients are in perfect clinical health except for marked vaginal stenosis.

DISCUSSION

In spite of the small number of cases, it seems that their analysis in comparison to other series reported in the literature permits us to arrive at certain pertinent conclusions.

It has been claimed that the supposedly poorer prognosis of vaginal carcinoma as compared to carcinoma of the cervix is due to a lower degree of histologic differentiation (Moench) and to the rich lymphatic network in the vaginal submucosa. Each of these factors would tend to favor early lymphatic spread. An analysis of the material reported from the Institut Curie and of our own cases does not support this pessimistic view. Histologically all of our cases were of a low degree of differentiation. According to the grading of our pathologist, Dr. Paul K. Lund, 8 of the 10 cases are classified as Grade III and two as Grade II of Warren's classification, which would correspond approximately to Broders' Grades IV and III, respectively. Yet only one of the patients with locally controlled disease died of lymphatic spread beyond the treatment area. It seems, on the contrary—perhaps because of the greater radiosensitivity of the less differentiated tumors—that even locally far advanced disease is still controllable (Cases 3 and 4). Way has pointed out that in vaginal carcinoma, because of the thin

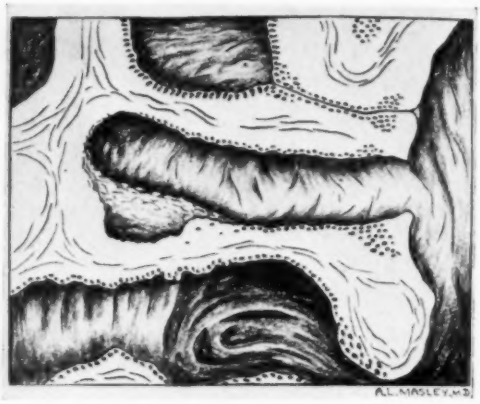

Fig. 6. Case 6: Epidermoid carcinoma, Grade II; clinical Stage II.

vaginal wall and its rich lymphatic network, infiltration of the rectovaginal and vesicovaginal septum may occur at a comparatively early stage and does not necessarily have the same poor prognostic significance as in cancer of the cervix, where it is more usually associated with extensive disease in the parametria and higher pelvic structures and indicates a more advanced stage.

More likely the generally poor results reported in the literature are explained by a technic which is not adequately adjusted to the characteristics of this tumor in so far as it does not sufficiently cover the potentially involved lymphatic area. Way has made an instructive analysis of 27 cases of vaginal carcinoma treated by local radium application. Seven of the patients have remained symptom-free for three to thirteen years. But the interesting point is the relationship of location of lesion in the vagina to the adequacy of technic of treatment and to the consequent result.

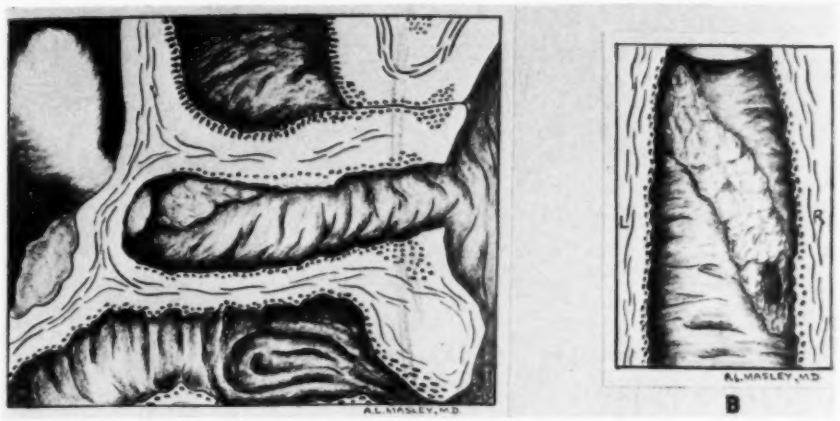

Fig. 7. Case 7: Epidermoid carcinoma, Grade III; clinical Stage III.

Fig. 8. Case 8: Epidermoid carcinoma, Grade III; clinical Stage I.

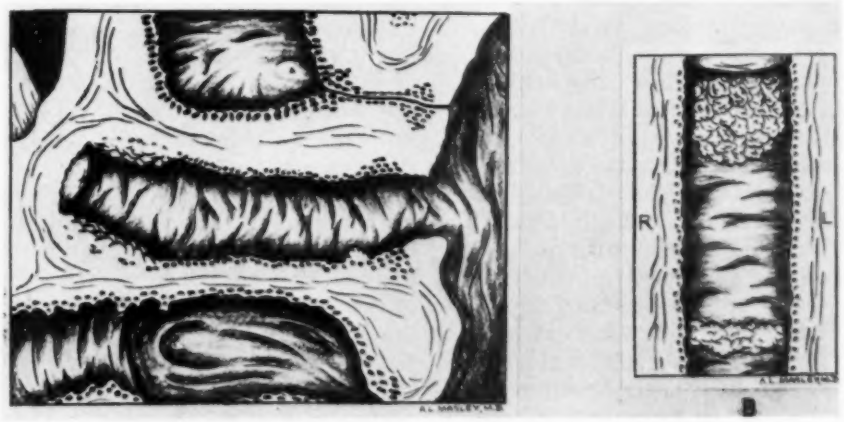

Fig. 9. Case 9: Epidermoid carcinoma, Grade III, with leukoplakia; clinical Stage II.

Fig. 10. Case 10: Epidermoid carcinoma, Grade II; clinical Stage II.

Of 11 patients with carcinoma in the upper third of the vagina, 6 were symptom free for more than four years. These patients were treated by a technic similar to that used in carcinoma of the cervix (Stockholm or Manchester). For lesions in the upper third such a procedure delivers an adequate dose to the tumor. On the other hand, of 7 patients with lesions extending into or originating below the upper third and treated by an unmodified cervix technic, none survived the first year.

From the results obtained at the Institut du Radium and in our own cases, it would seem that adequate external roentgen therapy directed toward and including the entire vagina and paravaginal area is an essential part of therapy and that local radium application alone is in many instances not successful, particularly since adequate radium application to cover a sufficiently large portion of the vaginal wall with a homogeneous maximal dose is more difficult in vaginal carcinoma than in carcinoma of the cervix, because of the thin vaginal wall and the difficulty of keeping applicators securely in place. In all but the very early cases, it seems to us preferable to conclude the full course of roentgen therapy first and to add local radium therapy to the remaining central portion of the tumor. In this way, the anatomical condition becomes more favorable for radium application and the risk of break-down, with fistula formation, is minimized if roentgen therapy is given slowly enough to allow for fibroblastic replacement of disintegrating tumor. It is, of course, essential to observe during roentgen therapy for shrinkage of the vagina in order not to jeopardize the radium application.

SUMMARY

1. Ten cases of primary carcinoma of the vagina treated between 1942 and 1946 are presented. Six of these patients are well, without clinical signs of active disease, for periods of three to six and a half years.

2. Treatment consisted of radical external roentgen therapy, complemented by local radium application. The importance of external irradiation in view of the rich lymphatic network of the vagina and of the low degree of histologic differentiation of these tumors is emphasized.

3. From an analysis of these cases and similar results obtained at the Institut du Radium (Paris), it is believed that the opinion of a particularly poor prognosis of carcinoma of the vagina, reflected in the literature, is due to the insufficient external irradiation used in many instances.

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SUMARIO

Radioterapia del Carcinoma de la Vagina

Esta exposición comprende 10 casos de carcinoma primario de la vagina, tratados entre 1942 y 1946. Seis de las enfermas se hallan bien, sin signos clínicos de enfermedad activa, habiendo esto durado de tres a seis y medio años.

El tratamiento consistió en roentgenoterapia externa radical, complementada con la aplicación local de radio. Recálcase la importancia de la irradiación externa, dada la rica red linfática de la vagina y la escasa diferenciación histológica de estos tumores.

Por el análisis de estos casos y los resultados similares obtenidos en el Institut du Radium de París, parece que la opinión, reflejada en la literatura, de un pronóstico por demás malo en el carcinoma de la vagina, procede de la insuficiente irradiación externa usada en muchos casos.

The Roentgen Appearance of the Central Fat Tissue of the Kidney: Its Significance in Urography[1]

FRANK WINDHOLZ, M.D.[2]

THE CENTRAL OR peripelvic fat tissue of the kidney is a normal anatomical constituent of the renal hilus and sinus. It enters the hilus with the renal pedicle, passes upward and into the central cavity (sinus) of the kidney, and extends to the inner aspect of the renal parenchyma at the floor of the sinus. The kidney pelvis and the major and minor calyces, branches of the renal artery, and tributaries of the renal vein are embedded in this fat tissue, which entirely covers their surfaces (Fig. 1A). Sometimes the extrarenal pelvis, too, may be surrounded by fat lobules. Little attention has been paid to this central fat tissue by anatomists and pathologists, and there has been no previous radiological study of its appearance and significance.

Due to the difference in x-ray absorption between the renal parenchyma and the fat tissue (Fig. 1B), the latter is not infrequently recognizable in roentgenograms of the kidneys. The translucency produced by the fat usually occupies the central and medial areas of the kidney shadow. It is fan-shaped or trapezoid in outline, irregular or spotty, according to the anatomic distribution of fat lobules. If the translucent area is fan-shaped, its apex lies near or in the hilus, while its outer border lies along the inner aspect of the kidney parenchyma (Fig. 2A). If the kidney is rotated about its long axis, the translucency becomes narrow and tends to lie in the central area of the kidney shadow (Fig. 2B). The irregular saw-tooth appearance frequently seen on the inner border of the parenchymal shadow at the lateral margins of the translucent area is due to the alternating projection of the renal papillae into the sinus and the columns of Bertin dipping between them. The borders of the kidney shadow itself and the outlines of the central fat tissue together demonstrate the kidney parenchyma (cortex and medulla). The fat accompanying the calyces to their particular pyramids may produce extensions far out into the cortex. Here it appears on excretory urographs as a narrow translucent halo surrounding the major calyx on all sides. The variation in distribution of fat is great and often differs between the two kidneys of one individual.

Visualization and recognition of the central fat tissue are often disturbed by air-containing intestinal loops. The saw-tooth margins of the air-distended descending duodenum may be confused with the lateral margins of the central fat tissue. In such instances a comparison of films taken in supine and erect positions and, specifically, laminagraphs will aid interpretation.

The translucency of the fat and the inner outlines of the kidney substance are clearer in the early stages of excretory urography than they are in plain or retrograde films, for dye excreted into the parenchyma increases its opacity without influencing the radiolucency of the fat. Moreover, in early urograms the calyces and kidney pelvis are often incompletely filled with opaque urine. Their shadows overlie only negligible areas of the renal sinus or hilus. Consequently, a maximum amount of fat tissue is accessible to observation.

All of our studies were made during routine examinations. No special procedures were used except laminagraphy when needed to bring out more clearly outlines of the fat and of the floor of the sinus. On good laminagraphs, the fat tissue is usually recognizable even when ordinary films fail to exhibit its outlines (Fig. 3).

[1] From the Department of Radiology, Stanford University School of Medicine, Stanford University Hospital, San Francisco, Calif.

[2] Dr. Windholz died on April 29, 1950. This article, submitted prior to his death, should serve as a tribute to his keen scientific interests and meticulous observations in the field of roentgenology.

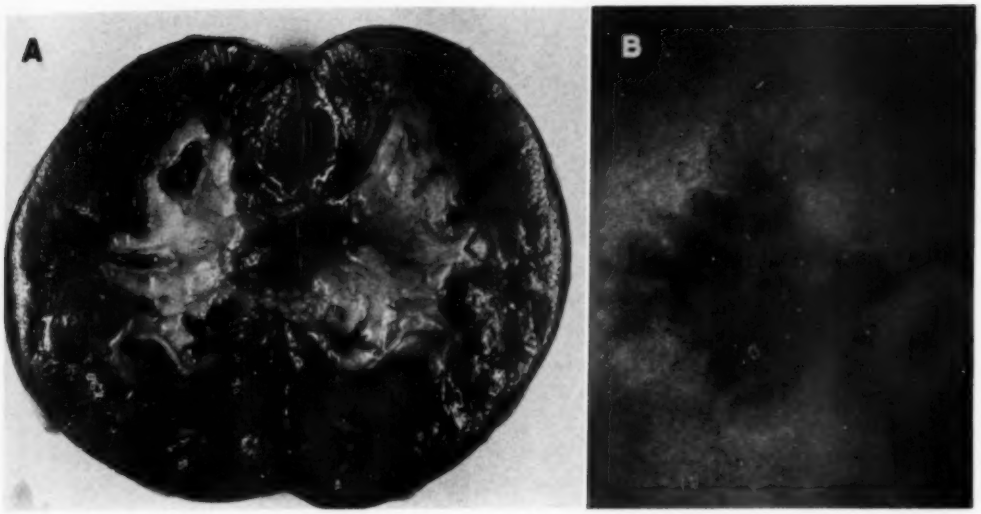

Fig. 1. A. Longitudinal section through normal kidney of 48-year-old, healthy, well nourished man who died in an automobile accident. Note that central fat tissue occupies almost one-third of the cut surface of the kidney. It extends everywhere to pyramids and medulla and follows several minor calyces deep into the parenchyma.

B. In a roentgenogram of the specimen (in water phantom) the fat tissue appears as a fan-shaped radiolucency. The hilus is on the right side of the picture. A saw-tooth appearance of the lateral outlines of the radiolucent area is caused by alternating projections of renal papillae and medulla.

In the writer's experience the central fat tissue is most often seen on urograms of well nourished middle-aged individuals. It is regularly seen in obese patients in whom the translucency may occupy more than one-half of the kidney shadow. It is rarely demonstrable in young, thin, or emaciated persons, except by laminagraphy.

Roentgenograms of the kidneys of 52 clinically healthy patients revealed that within certain limits a roughly constant ratio could be established between the thickness of the parenchyma and that of the central fat tissue. This ratio is obtained by first drawing a line through the middle of the kidney shadow at a 90-degree angle to the longitudinal axis. The thickness of the parenchyma (P) and of the central fat tissue (F) are then measured separately. The ratio of the parenchyma to fat (P/F) roughly averages 1/0.8 or 0.9 in middle-aged patients; in older patients it gradually decreases, reaching at times 1/.2 or less.

This ratio does not establish an accurate quantitative relationship between the

Fig. 1. C. Left kidney five minutes after injection. Outlines of renal papillae project into the fat-containing sinus. Margins of renal (Bertin's) columns alternate with elevations of papillae. The patient was a 63-year-old man with no urinary disease.

Fig. 2. A. Right kidney of a 51-year-old woman with urinary frequency, five minutes after injection. Fan-shaped distribution of central radiolucency exhibiting characteristic margins of inner aspect of kidney substance (floor of the sinus). The saw-tooth appearance of the lateral borders of the radiolucency corresponds to alternating projections of renal papillae and of the medulla dipping into the fat-containing sinus.

B. Large longitudinal area of translucency in left kidney, which is rotated around its long axis and is displaced by a large spleen. Papillae and medulla are clearly visualized. The patient was a 48-year-old man with splenomegaly.

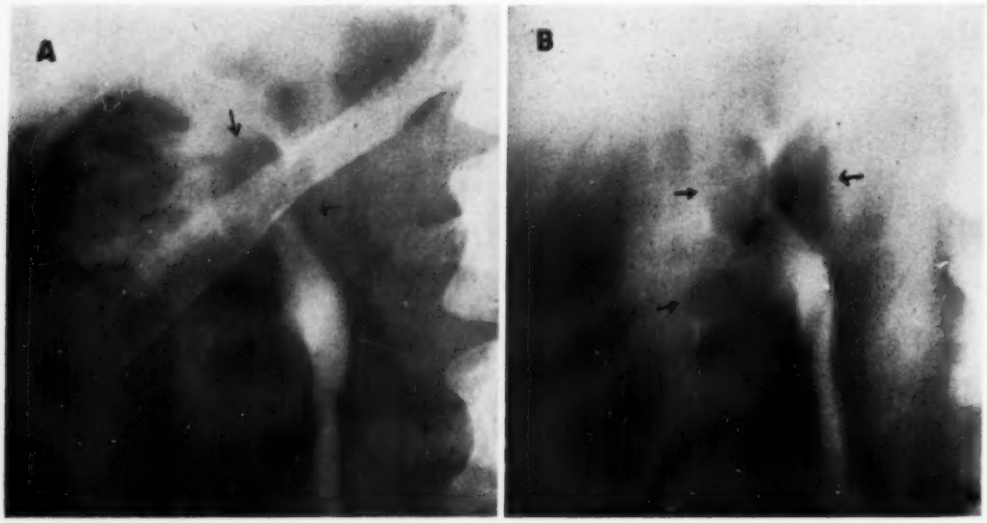

Fig. 3. A. Right kidney of a 19-year-old woman with cystitis, fifteen minutes after injection. The kidney shadow, calyces, and area of central fat tissue are partly obscured by gas-containing intestinal loops. Vague outlines of central fat are seen around calyces.

B. Laminagraph of same kidney taken at 6 cm. ventralward from skin of back. Note clear visualization of central fat tissue.

amount of renal parenchyma and fat tissue. It serves, however, to call attention to a possible gross reduction of the kidney parenchyma, or parts of it, and to a corresponding increase in the amount of the central fat tissue.

During the last seven years the roentgen appearance of the peripelvic renal fat tissue has been studied in 2,321 routine urograms made in the X-Ray Department of Stanford University Hospitals. These represented patients of all ages, both sexes, with and without clinical and laboratory findings of disease of the urinary tract.

Attention was directed first toward establishing signs and variations of the appearance of the fat tissue and its relationship to the inner aspect of the kidney parenchyma (floor of the sinus) in normal individuals. Groups of patients were then selected in whom a diffuse increase in the amount of fat tissue and reduction of the renal parenchyma might be expected, namely obese persons with hypertrophy of the capsular fat tissue and patients with atrophic kidneys. In the latter group pathologists regularly observe increase of the central fat tissue, which proliferates to replace the shrunken parenchymal structures. Finally, roentgen signs of circumscribed reduction of the parenchyma and compensatory fat proliferation and also primary fat hyperplasia were studied, and their diagnostic usefulness was investigated.

Group I: Proliferation of the Central Fat and Changes in the Appearance of Calyces in Obesity: Anteriorly, posteriorly, and laterally the walls of the kidney sinus are solid parenchyma. On the medial side lies the flexible, distensible structure of the renal hilus. If the fat tissue of the sinus proliferates, as in obese patients, it can hardly extend toward the kidney substance because of the rigidity of the walls. Thus, in the course of its growth it will compress and elongate the flexible calyces and the pelvis. The result of this is narrowing, elongation, and separation of the calyces and a small compressed kidney pelvis surrounded by an increased area of radiolucent fat tissue. These are the characteristic urographic findings in obese patients in whom the proliferation of renal fat tissue is considerable. In many instances, the major calyces become so narrow, as a result of compression by the fat tissue, that they appear empty during the entire course of the routine examination, and only dye accumulation in minor calyces and in the pelvis and ureter indicates normal function of the kidney parenchyma.

Often on routine urograms only this remarkable "empty" appearance of the calyces is seen and no translucencies representing fat tissue are found. Laminagraphic studies of such kidneys, however, may disclose the presence of increased amounts of fat tissue surrounding these "empty" calyces. So regular is this relationship that circumscribed fat accumulation can be predicted even when a single major calyx exhibits the picture described above. The appearance of "empty" calyces is quite similar to that of "spastic" calyces considered indicative of infection of the kidney pelvis.

It is likely that the mechanical effect of compression by elastic fat lobules is the sole cause of these characteristic deformities of the renal collecting system. In advanced central lipomatosis, microscopic studies show that fat cells may proliferate into the outer layers of the calyceal walls, separating connective fibers and blood vessels from the wall itself. Whether or not such fat infiltration contributes mechanically to the remarkable appearance of the calyces cannot be decided conclusively. Further anatomical studies would be necessary to permit the exclusion of neuromuscular imbalance of the walls caused by proliferating fat cells.

Group II: Fat Proliferation and Appearance of Calyces in Atrophy of Kidneys; "Central" Kidney Atrophy: According to present practice, it is assumed that the kidney is atrophic or hypoplastic when the longitudinal and transverse dimensions of its shadow are less than normal and foreshortening has not occurred. This is obviously correct in cases in which atrophy of the kidney parenchyma is associated with

Fig. 4A. "Central" atrophy of kidney in a 64-year-old man with hypertension. Normal-sized kidney shadow, narrow cortex; calyces and kidney pelvis compressed by proliferating central fat tissue.

decrease in the size of the kidney itself. Pathologists, however, estimate atrophy not only by decrease of the dimensions of the kidney but also by shrinking of its substance with or without change in the size of the kidney itself. Roentgen visualization of the floor of the sinus (inner aspect of the kidney parenchyma) in the present studies makes it possible to estimate roughly the amount of kidney substance (cortex and medulla) independent of the size of the kidney. Heretofore, only the kidney shadow as a whole was the basis of diagnostic considerations.

Experience shows that in all forms of kidney atrophy the central fat tissue is apt to proliferate, filling up the space produced by retraction of the parenchyma. Characteristic changes are thus produced on the urogram, notably narrowing of the parenchyma and a proportionate increase of the extent of fat translucency. The appearance of the calyces and the kidney pelvis is very similar to that seen in primary proliferation of the central fat tissue in obese persons. The major calyces are elongated and separated by the proliferating fat tissue in the central cavity of the kidney. The only difference is that in atrophy the parenchyma is narrowed, whereas in obesity its width remains normal. When the atrophy is considerable, the distance of the renal papillae from the kidney pelvis increases and the

Fig. 4B. Characteristic appearance of primary and secondary calyces and kidney pelvis in "central" atrophy of kidney in an obese 58-year-old man with hypertension. The size of the kidneys has not diminished; the parenchyma is narrow; the primary calyces are stretched, empty, and hardly visible; the kidney pelvis is not filled. Parenchyma/fat ratio is diminished. (Translucency of fat more marked on films than on print.)

major calyces become unduly elongated. In such cases the appearance of the renal excretory tracts may even approach that of the so-called "spider-leg deformity." Such "spider-leg" calyces have been considered to be a roentgen sign of renal tumor, but our studies show that similar

changes may be caused solely by reactive proliferation of the central fat tissue in the presence of atrophy of the parenchyma. But while tumors are of soft-tissue density fat proliferation is manifested by translucent areas in the region of the "spider legs."

Since the dimensions of the kidney parenchyma (substance of the kidney) were not previously considered separately from the kidney shadow itself, no attempt could have been made to determine x-ray signs of kidney atrophy in cases in which the total size of the kidney shadow was not obviously diminished. Such changes are not uncommon.

Fig. 4C. Same case as in Fig. 2B, showing some narrowing of the renal parenchyma and increase of the central fat tissue on the left. The kidney is rotated, and the fat is located more in the medial sections of the kidney shadow. Note difference between appearance of calyces on the left and on the right. On the left, they are almost empty, due to compression by increased amount of fat tissue. Cause of atrophy in this case probably nutritional, due to differences of vascularization and blood supply to the left kidney in presence of enormous splenomegaly on the left.

Anatomically these kidneys are characterized by narrowing of the parenchyma and no gross shrinkage of the organ. The atrophy is established by the pathologist from the adherence of the renal capsule to the parenchyma, roughness of the surface, narrowing of the cortex, and increase of the central fat tissue. Microscopic findings in most instances indicate an arteriosclerotic process. Roentgen signs of this form of atrophy are: normal size of the kidney shadow, narrowing of the parenchyma, increased size of the central translucency, "empty" appearance of the calyces and of the kidney pelvis (Fig. 4A and C). The parenchyma-fat ratio in such cases is decreased. Because radiological signs in this form of atrophy are exhibited at the inner aspect of the parenchyma and in the central portion of the kidney shadow, I propose to refer to it in the radiological code as "central atrophy" of the kidney. This name does not cover

Fig. 5. Calcifications and extensive replacement of the substance of the right kidney by fat in chronic, inactive renal tuberculosis in a 52-year-old man. Note dark radiolucency occupying area of renal parenchyma. Tuberculous calcifications seem to be imbedded entirely in lipomatous structures ("autonephrectomy"). No diodrast was excreted.

precisely the sequence of pathological events, but it may help to differentiate the roentgen signs from those of ordinary kidney atrophy.

Signs of central atrophy are relatively frequent in hypertensive disease of obese individuals (Fig. 4A and B).

Group III: Circumscribed Deformity of the Parenchyma and Appearance of the Central Fat Tissue in Chronic Inflammatory Conditions of the Kidney: In chronic inflammatory conditions, signs of circumscribed fat proliferation are recognizable whenever circumscribed atrophy of the kidney occurs and the cicatrized parenchyma is replaced by fat tissue. This extends from the sinus into the defect caused by local contraction of the kidney.

Such localized cicatrization is most frequently seen in chronic pyelonephritis, in scars of infarcts, nephrolithiasis with infection, etc. At times local fat proliferation with corresponding compression of calyces may be the only sign of cicatrization of the parenchyma. This occurs when the scar is situated chiefly in the medulla, the outer borders of the kidney itself are not deformed, and the kidney shadow appears normal. Because of this, it is advisable, whenever such problems present themselves, to attempt to visualize the inner aspect of the medulla (floor of the sinus) and its relationship to the fat tissue, if necessary by laminagraphy.

Very extensive fat proliferation was found in one case of chronic, clinically inactive, calcified, tuberculous, contracted kidney. In this instance the entire kidney shadow was replaced by fat, the kidney failed to excrete dye, and it appeared as though the calcifications had been embedded in fat tissue ("autonephrectomy") (Fig. 5). Similar excessive lipomatosis was noted in several cases of kidney stone. The frequent coincidence of these conditions is known to pathologists. Gottstein (1) attempted to establish a pathological entity of "lipomatous stone kidneys." He stated that the fat proliferation develops in the capsule of the kidney and extends from the outside into the hilus. No reference to these findings was discovered in the radiological literature, although such a roentgenogram is reproduced by Young and Waters (2) in connection with calcifications in tuberculous kidneys.

The author has had very little opportunity to prove the relationship between localized cicatrization of parenchyma and fat proliferation on pathological specimens and has searched fruitlessly for references to the distribution of the central fat tissue in such conditions. Fibrosis of fat tissue and inflammatory changes extending from calyces into the adjoining fat are described by Putschar (3), but so far as is known, no studies are recorded purporting to demonstrate the morphology of the renal fat tissue in deformities following chronic pyelonephritis. It is to be assumed, however, that with progress of our

knowledge of the distribution of the central fat tissue in pathological conditions more light will be thrown on the diagnostic value of its x-ray signs.

Group IV: Deformities of Calyces and Kidney Pelvis in Circumscribed Primary Fat Proliferations Without Atrophy of the Parenchyma: The central fat tissue of the kidney proliferates diffusely when the stimulus comes from diffuse extrinsic factors (diffuse atrophy) or diffuse intrinsic factors (obesity). It may proliferate in a circumscribed manner in cicatrized kidneys following chronic pyelonephritis with or without stones, scars of infarcts, etc. Signs of circumscribed *primary* proliferation were encountered in normal, not obese, patients with normal-appearing kidney parenchyma. The nature of these proliferations is not described in available references, but it seems that they belong to groups of circumscribed primary hyperplasias of the central fat tissue of the kidney. They are not identical with the true lipomas of the kidneys, which occur in the cortex, are very rare, and do not exceed 0.5 cm. in diameter.

The effects of these circumscribed growths of the fat tissue on the calyces are similar to those of tumors. The rigidity of the unaffected walls of the sinus does not permit extension into the parenchyma. Because of this, the calyceal and pelvic deformities will be more marked and will differ in appearance from deformities caused by diffuse fat proliferation. Characteristic findings are more or less marked flattening and compression of the kidney pelvis and of major and minor calyces, and displacement of these structures in accordance with the localization and the extent of growth of fat lobules. The significant difference between deformities caused by fat tissue and those caused by parenchymal tumors lies only in the appearance regional to the deformed parts of the upper excretory tracts: in cases of fat proliferation there is radiolucency; in the presence of parenchymal tumors, soft-tissue opacity.

Two cases of circumscribed proliferation of fat tissue in the sinus of the kidney were operated upon in our hospital before experience had been gained on the value of roentgen signs of lipomatose structures in the kidney. In both instances marked deformity of the renal pelvis and calyces was found. In each case the pathological examination revealed that the cause of the deformity was hyperplasia of fat lobules rather than a parenchymatous tumor. Review of the films in retrospect showed marked radiolucency of the structures surrounding the deformed calyces instead of opacity (Fig. 6).

Fig. 6. Marked compression, flattening, and displacement of right kidney pelvis and elongation of caudad calyx by advanced, circumscribed proliferation of central fat tissue. Appearance is that of a renal tumor. Note that surrounding of kidney pelvis and of calyces is radiolucent instead of being of soft-tissue density, as would be expected in the presence of a parenchymal tumor. At operation marked fat proliferation was seen. No tumor was found. Clinically, microscopic hematuria.

Group V: Roentgen Signs of Fat Tissue as an Aid in Tumor Diagnosis: Radiologic study of the central fat tissue may be helpful in two ways as a diagnostic aid in establishing a diagnosis of neoplastic lesions.

If tumors invade the central excavation

Fig. 7. Large hypernephroma obliterating lower and middle portions of central fat tissue, pushing entire hilus with kidney pelvis upward. Note calcifications at margins of tumor.

of the kidney, the radiolucent areas may be replaced by the soft-tissue shadow of the tumor. In such instances, the calyces are almost always already deformed or displaced, or both, and the obliteration of fat tissue is only corroborative evidence of the presence of the tumor (Fig. 7). We observed no cases in which the diagnosis could be established solely on the basis of protrusion of the soft-tissue shadow of the tumor into the central translucency, but in four instances this was of aid in the final diagnosis.

More important and more common are cases in which deformity and elongation of a single calyx, often the craniad, suggest a neoplastic lesion. As indicated above, the central fat tissue accompanies each major and minor calyx to its respective pyramid. It is recognizable on the roentgenogram as a narrow, radiolucent halo around the borders of the calyces, even though they join their pyramids far inside the substance of the kidney. Consequently, the radiographic demonstration of an uninterrupted fat layer around an elongated calyx indicates that the elongation is not due to neoplastic growth, specifically not to an infiltrative tumor (Fig. 8), while absence of such a layer suggests that the elongation of the

Fig. 8. Left kidney of 38-year-old woman with backache and microscopic hematuria. Note long cephalic calyx with radiolucent halo on both sides, indicating that central fat tissue accompanies this calyx to its papilla. In the presence of an uninterrupted fat layer around this long calyx, it is most unlikely that elongation is caused by tumor growth. It represents, rather, an anatomical variation. No change has occurred in x-ray appearance during one year of observation.

calyx is most likely attributable to a tumor.

Four cases were observed in which the disproportionate elongation of a major calyx would ordinarily have been taken to indicate the presence of a tumor. Two of the cases were from a recent series and 2 were found in files of previous years. All 4 cases revealed a radiolucent halo surrounding the elongated calyx, thus indicating that it was accompanied by extensions of the central fat uninterrupted by pro-

liferations of parenchymal structures. This led me to believe that the elongation was not the result of a tumor but represented rather an anatomical variation. Repeated x-ray examinations, clinical observations, and laboratory tests made periodically over a six-year period revealed no change in the

Fig. 9A. Double kidney pelvis and ureter in left kidney of 4-year-old child (clinically, infected left kidney). Diodrast outlines only the lower pelvis and calyces. The faint radiolucency in the upper medial area of the kidney shadow indicates the presence of a second kidney pelvis. This was later demonstrated by retrograde pyelography.

appearances of the calyces, and no other findings developed to indicate the presence of a tumor.

Although no generalizations can be made on the basis of these 4 observations, it is believed that where the diagnosis is dubious, signs of a fat tissue halo around the calyces are presumptive evidence of the absence of a neoplastic lesion in the vicinity. Where there is doubt, the attempt to demonstrate this sign by laminagraphy should not be omitted.

Group VI: Peripelvic Fat in Congenital

Fig 9B. Double kidney on right showing translucent areas in connecting portions of both kidneys. This indicates that the substance of the kidneys is fused by parenchymal structures. Kidneys contain a common sinus with two separate collecting systems and two ureters.

Anomalies of the Kidneys: The signs and distribution of the central fat tissue may help in the recognition of horseshoe kidneys, ectopic kidneys, and double renal pelvis prior to and during urography.

The observer, for instance, may be misled when only one kidney pelvis is demonstrated and a double kidney pelvis is suspected. He may assume that a single pelvis is present and that the kidney contains a tumor which occupies the area of the other pelvis. Distribution of the peripelvic fat tissue showing the presence of irregular, spotty radiolucencies in the kidney shadow outside of the area of the excretory tracts, demonstrated by excretory urography, arouses suspicion of the presence of a non-functioning second kidney pelvis (Fig. 9A). This can be verified by retrograde urography.

Valuable information may be obtained by study of the central fat tissue in differentiation of double kidneys from crossed ectopy or fusion in cases of horseshoe kidneys. In these instances, the question may arise as to whether there is parenchymal or capsular fusion, or whether it is entirely absent. Surgical decisions may depend upon the correct answer to these questions. In Figure 9B, the central fat tissue extends from the sinus of the upper kidney through the connecting portions of the kidney shadow into the sinus of the lower kidney, indicating that the kidneys are fused by parenchymal tissue.

SUMMARY

An attempt has been made to describe the roentgen signs of the central (peripelvic) fat tissue of the kidney as they appear on routine urograms and in laminagraphic examinations. Emphasis is placed upon the fact that visualization of the fat tissue makes possible observation of significant parts of the inner aspect of the kidney parenchyma (floor of the sinus, renal papillae, and Bertin's columns). The substance (parenchyma) of the kidney is outlined between the lateral margin of the radiolucent fat and the border of the kidney shadow.

Normally a fairly constant ratio exists between the thickness of the renal parenchyma and the central fat tissue; this is 1 to 0.8 or 0.9 in persons of middle age, decreasing with advancing age to 1 to 1.2 or less.

Diffuse proliferations of the central fat tissue are observed in obesity and in diffuse atrophy of kidneys. Circumscribed proliferations are encountered in circumscribed atrophy of the kidneys in chronic pyelonephritis, kidney stones, infarct scars, etc., as well as in circumscribed primary hyperplasias of the fat tissue itself.

The effect of fat proliferation, diffuse or circumscribed, on calyces and kidney pelvis, is uniform. In both conditions it causes narrowing (compression), separation, and elongation of calyces and narrowing of the kidney pelvis.

The practical results of these studies for urography are as follows:

1. Spastic appearing "empty" calyces are frequently caused by uncomplicated proliferations of the central fat tissue and not by infection of the kidney pelvis.

In the presence of increased amounts of fat (obesity, atrophy) this appearance is the rule. It may be exhibited by both kidneys or by only one (diffuse fat proliferation) or by parts of one kidney (circumscribed fat proliferation).

2. Isolated "spastic" calyces surrounded by circumscribed fat proliferation may indicate localized parenchymal atrophy due to inflammatory or nutritive damage to the kidney parenchyma.

3. Atrophy of the kidney parenchyma may be recognized on urograms in cases in which the size of the kidney shadow is not diminished. In such conditions the radiolucency caused by the central fat tissue is enlarged, the parenchyma is narrowed, the calyces appear empty or spastic ("central atrophy").

4. Circumscribed primary fat proliferations may cause deformities of calyces and of the kidney pelvis which are identical in appearance with deformities caused by parenchymal tumors. Differentiation is based on the radiolucency of fat and the opacity of tumors. Obliteration of the central fat tissue may be diagnostic of renal tumors.

5. Study of distribution of the central fat may be helpful in recognition and clarification of certain malformations of the kidneys.

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SUMARIO

El Aspecto Roentgenológico del Tejido Adiposo Central del Riñón: Importancia del Mismo en la Urografía

Trátase aquí de describir los signos roentgenológicos del tejido adiposo central (peripelviano) del riñón, según aparecen en los urogramas corrientes y en los exámenes laminagráficos. Recálcase el hecho de que la visualización de dicho tejido permite observar partes importantes de la cara interna del parénquima renal (suelo del seno, papilas renales y columnas de Bertin). La sustancia (parénquima) del riñón queda demarcada entre el borde lateral del radioluciente tejido adiposo y el borde de la sombra renal.

Normalmente, existe una razón bastante constante entre el espesor del parénquima renal y el tejido adiposo central: 1 a 0.8 ó 0.9 en las personas de edad mediana, disminuyendo a medida que avanza la edad hasta 1 por 1.2 o menos.

En la obesidad y en la atrofia renal difusa, obsérvanse proliferaciones difusas del tejido adiposo central, en tanto que descúbrense proliferaciones circunscritas en la atrofia circunscrita de los riñones, la pielonefritis crónica, los cálculos, infartos, cicatrices renales, etc., e igualmente en casos de hiperplasia primaria circunscrita del tejido adiposo mismo.

El efecto de la proliferación grasa, ya difusa o circunscrita, sobre los cálices y la pelvis renales es uniforme. En ambos estados, provoca estrechez (compresión), separación y alargamiento de los cálices y estenosis de la pelvis renal.

Los resultados prácticos de estos estudios para la urografía son los siguientes.

1. Los cálices "vacíos" de aspecto espasmódico son frecuentemente ocasionados por proliferaciones simples del tejido adiposo central y no por infección de la pelvis renal. En presencia de aumento del tejido adiposo (obesidad, atrofia), ese aspecto es lo habitual, pudiendo manifestarlo ambos riñones o sólo uno (proliferación grasa difusa) o partes de un riñón (proliferaciones grasas circunscritas).

2. Los cálices "espasmódicos" aislados y rodeados de proliferación grasa circunscrita pueden indicar atrofia parenquimática localizada, debida a lesiones inflamatorias o nutritivas del parénquima renal.

3. La atrofia del parénquima renal puede ser reconocida en los urogramas en los casos en que no ha disminuído el tamaño de la imagen renal. En esos estados, se agranda la radiolucencia producida por el tejido adiposo central, se estrecha el parénquima y los cálices parecen vacíos o espasmódicos ("atrofia central").

4. La proliferación grasa primaria circunscrita puede ocasionar deformidades de los cálices y de la pelvis renal, cuyo aspecto es idéntico al de las ocasionadas por los tumores del parénquima. La diferenciación entre proliferaciones grasas circunscritas y tumores se basa en la radiolucencia de la grasa y la opacidad de los tumores. La obliteración del tejido adiposo central puede ser diacírtica de los nefromas.

5. El estudio de la distribución del tejido adiposo central puede resultar útil en el reconocimiento y esclarecimiento de ciertas malformaciones renales.

A Simple One-Stage Method of Double-Contrast Study of the Colon[1]

ROBERT D. MORETON, M.D., EDWARD M. COOPER, M.D.[2], and EDWARD F. FOEGELLE[3]

THE DOUBLE-CONTRAST examination of the colon was first described by Fischer (1) in 1925. It has been popularized in this country by Weber and Gershon-Cohen, but we feel that it has not been utilized to its fullest extent. Realizing that the method previously described by one of us (4) is rather time-consuming and, as pointed out, may be completely ineffectual if the patient lingers too long at evacuation, we have devised a new and simpler procedure, with a special adapter to be used in carrying out the examination.

The importance of proper preparation of the patient bears re-emphasizing. Thorough cleansing of the bowel by both purgatives and small enemas is most essential for any reliable colon examination, the only contraindications being severe diarrhea, severe hemorrhagic tendencies in the gastro-intestinal tract, and acute or subacute obstruction.

After studying various types of barium (5), we now use a commercial preparation of barium sulfate containing a ready-mixed "suspending agent." We measure the barium by exact weight rather than volume and feel that this gives a more uniform mixture. The mixing is done in a baker's dough mixer, though in private practice or hospital practice an electric butter churn will serve the purpose. We have found that the capacity of a regular malted milk mixer is not sufficient to afford uniform mixing of the entire solution.

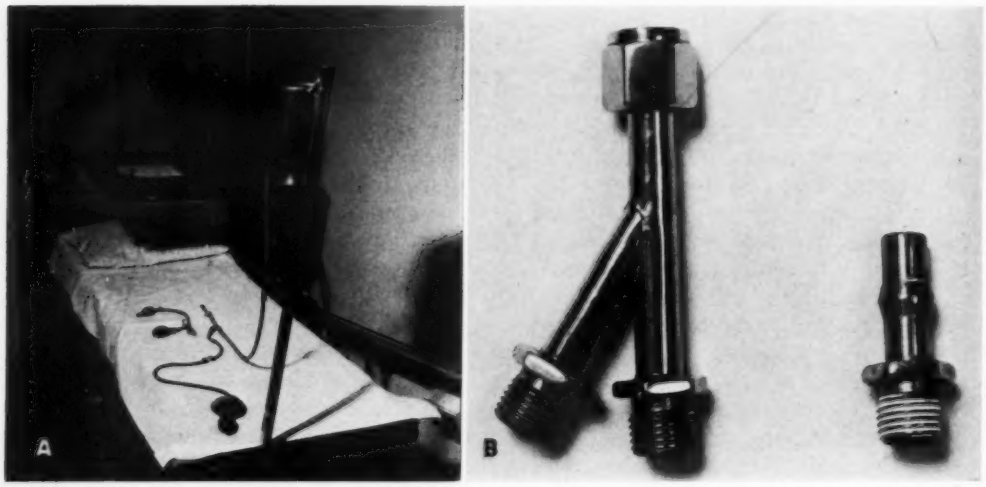

Fig. 1. A. Apparatus showing barium tube attached to straight arm of Y and Weber insufflator to side arm. This keeps tubes straight and prevents kinking. B. Adapter for attaching barium tube and insufflator. To the right is the accessory for attaching a Bardex or other type of catheter as desired, instead of the Carman tip.

Apparatus used for the double-contrast examination consists of the usual tilt-table fluoroscopic machine with a "spot-taking" attachment, a 2-quart metal enema can of common design with an attached 3- or 4-

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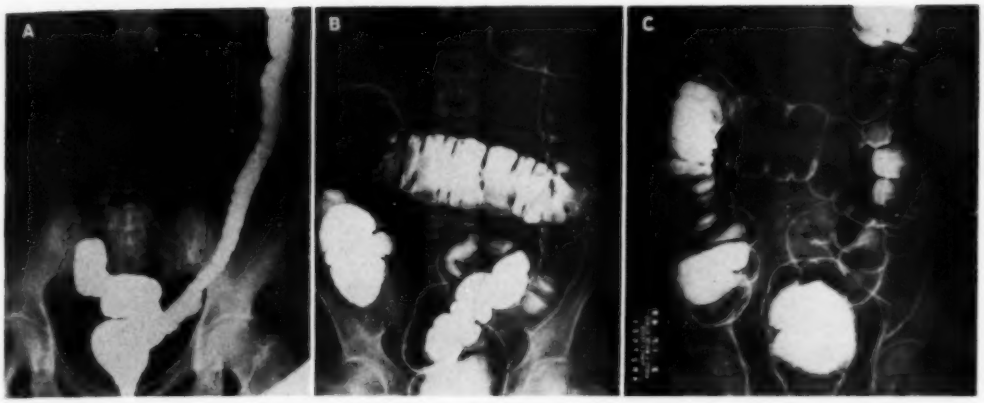

Fig. 2. A. Colon filled to splenic flexure. Note small amount of residual barium in cecum from stomach examination. B. Film made in prone position. C. Film made in supine position. Note redistribution of barium in the colon when the patient rolls from stomach to back. The entire colon can be well visualized on these two films.

foot rubber tube of adequate size, a suitable clamp for the tube, a Carman metal enema tip, a Weber insufflator, and the special adapter mentioned above.

The adapter (Fig. 1B) is a Y-type attachment threaded on one end for connecting the rubber tube to the enema can and on the other for attaching a Weber insufflator. To the single end of this adapter the Carman tip is attached (with the aid of an accessory, a Bardex catheter or any other type of rubber tip may be used). With this adapter the enema solution or air may be controlled at will.

When all is in readiness, the enema tip is inserted by an assistant. Then, after a preliminary "scout glimpse" of the abdomen, the barium solution, which has been previously heated to body temperature, is allowed to run slowly into the bowel. The opaque column is observed under the fluoroscope until it just reaches the splenic flexure (Fig. 2A). Since air is lighter than the barium, the table is tilted to a Trendelenburg position and the patient is rotated to the left. The assistant then injects the air at a moderate, steady rate. The head of the barium column is observed fluoroscopically and after an interval of a few moments for the barium to clear the sigmoid, the patient rolls on his back and slightly to the right. This helps keep the air toward the left side and forces the barium to the hepatic flexure and ascending colon. As the barium column reaches the hepatic flexure, the table may be leveled or the head may be slightly elevated, to permit filling of the cecum. If, on completion of the injection, the cecum and ascending colon seem to be overfilled, the patient may be rolled on the left side to redistribute the barium and air.

The barium column can be visualized at all times by rotation of the patient and, if an obstruction is met, the insufflation may be stopped immediately (Fig. 3) if necessary. At this point a word of warning must be added regarding over-distention of the bowel. If a regular enema tip is used, the patient will himself expel the air if the bowel is over-distended. This may be looked upon as a safety measure. When a Bardex catheter is used, however, it is impossible for the patient to expel the air and special caution is required on the part of the examiner.

As soon as the fluoroscopic examination is completed, films are then made stereoscopically in both prone and supine positions (Fig. 2B and C). When the patient is rotated from the prone to the supine position the barium column will shift, causing a re-distribution of the barium and air. Segments previously made opaque by barium are found to contain air and can be clearly visualized. We regard these ro-

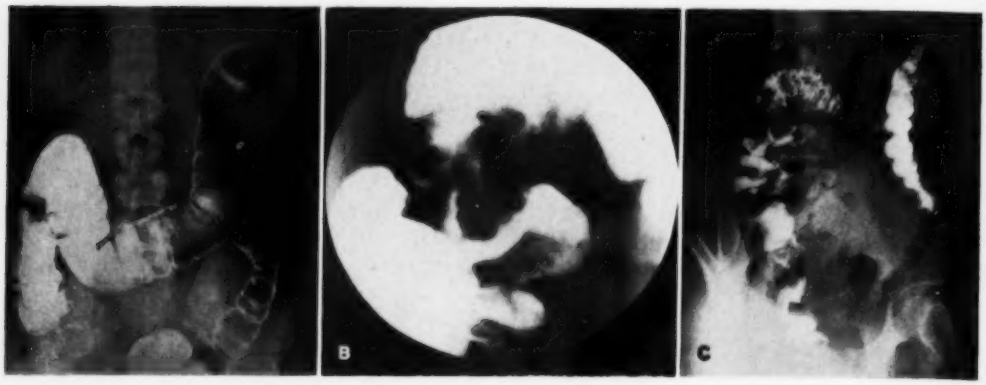

Fig. 3. A. Carcinoma of ascending colon visualized in barium column. Note air on left. B. Spot film of carcinoma. C. Evacuation film also demonstrating carcinoma.

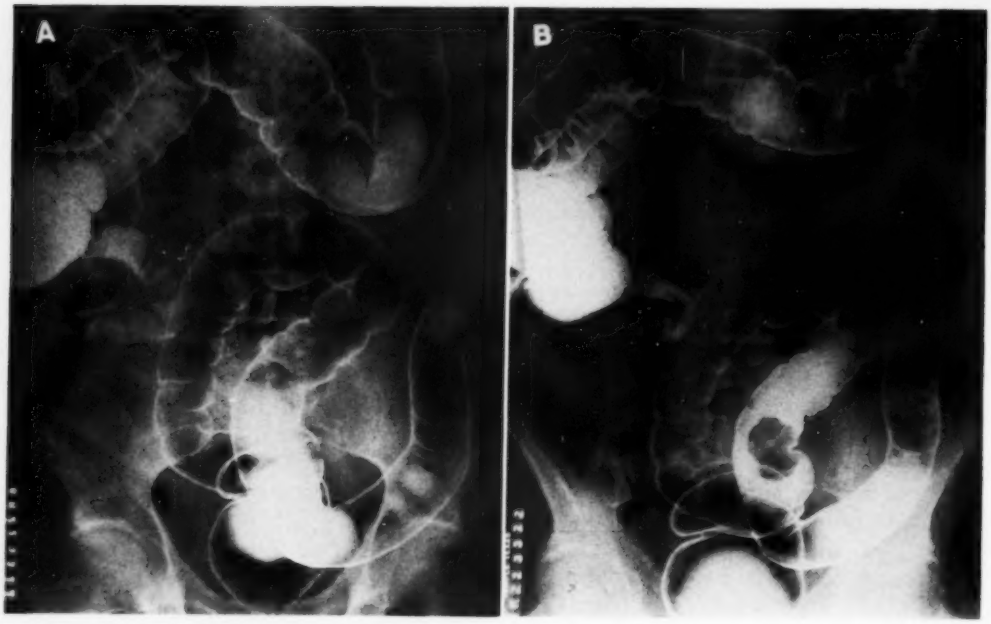

Fig. 4. A. Polyp obscured by barium. B. Polyp well visualized due to shift of barium when patient was turned over.

tation films as most important, since small polyps may be seen in one position and completely obscured by barium in the other (Fig. 4A and B). Some roentgenologists may feel that too many films are being used; in that case, we believe that single rotation films are more valuable than stereoscopic films in one position. Remembering the occurrence of fictitious polyps (6), we recommend re-examination in those instances where a suspicious but inconclusive shadow is seen. Many of these shadows may be eliminated on rotation films by shifting the patient from one position to another. When re-examination is necessary, stereoscopic films may be made for further help in studying the area in question.

With the large bowel filled with barium and air, a technic has to be employed that will completely penetrate the barium and

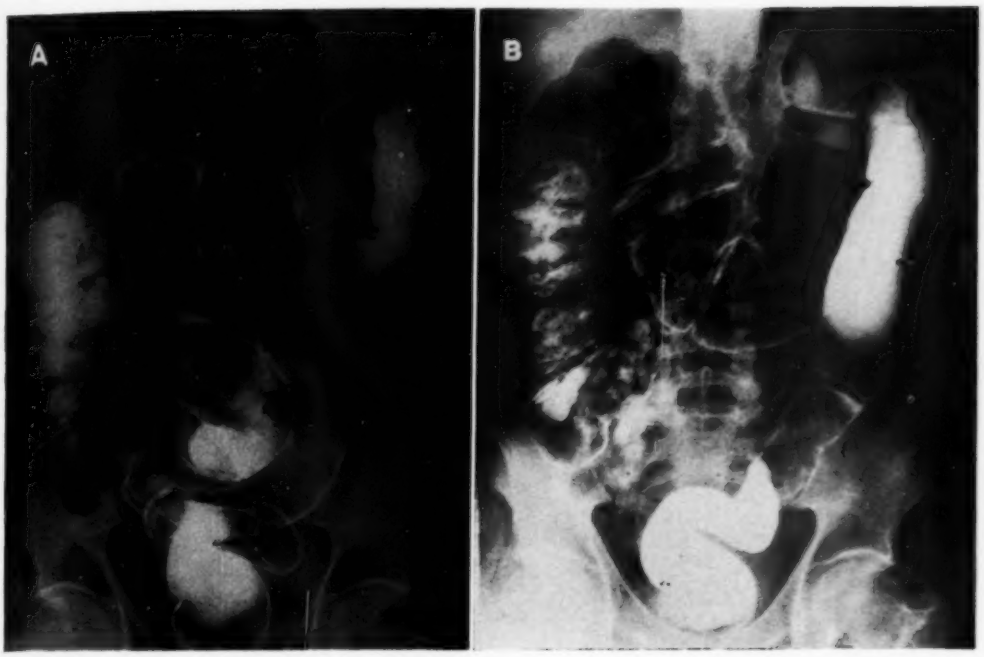

Fig. 5. A. Redundant loops of sigmoid with volvulus formation. This was previously missed on opaque enema examination, being reported only as malrotation. The marked narrowing seen with air could not be visualized fluoroscopically or on the films. Double-contrast study was done because the symptoms could not be explained. B. Same colon after resection of sigmoid. Patient completely relieved of symptoms.

yet not lose the fine detail produced by the air. With a low-kilovoltage, high-milliampere-second technic, the bowel, thinly coated with barium and filled with air, will be under-penetrated and the air-filled area will be too dark. The length of exposure in this type of examination is not satisfactory because of the involuntary motion of the bowel, which obscures radiographic detail. We employ a high-kilovoltage, low-milliampere-second technic. As stated by Fuchs (2), with low-kilovoltage, high-milliampere-second technics, the radiographic densities are very abrupt as compared to those obtained with high-kilovoltage low-milliampere-second procedures. On films produced at high kilovoltage the tone density is gradual, with gradations in the gray scale, never changing abruptly from a complete black to a complete white. We have found that by using 90 kv. p., 15 ma. seconds basic value, and 40 inches distance, the films show proper penetration, and, what is most important, the barium-coated air-filled areas are very sharply outlined. The density through the air sections is transparent to the ordinary fluorescent illuminator, never dark enough to require a strongly lighted illuminator. With the short exposure of 15 ma. seconds for the basic value, all involuntary motion is arrested. In addition, to the above factors, an 8:1 grid, fine-grain screen or equivalent, and time temperature processing should be used The basic value of 15 ma. seconds is used for the average patient of 18 to 22 cm. thickness. For patients in the less-than-average group the value is halved; for larger-than-average patients it is doubled. These factors are for full-wave rectified equipment only. If 15 ma. seconds does not give the desired density, the value may be increased or decreased accordingly. The kilovoltage and distance factors should never be changed. The same factors are used in all recumbent positions. Due to the great latitude obtained by using this type of technic, diag-

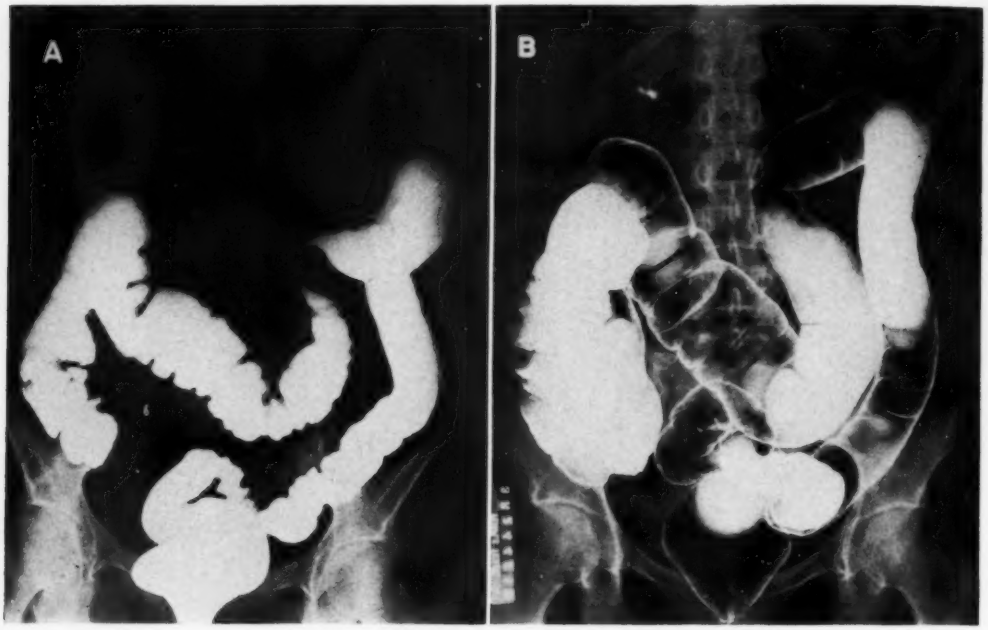

Fig. 6. A. Narrowing of distal transverse colon as seen when colon was filled with opaque medium. B. Double-contrast study revealing increase in size of lumen at site of narrowing. Being beneath an operative scar, this was felt to be due to adhesion.

nostic films of the highest quality are obtained.

Fischer, in his original paper, listed the advantages of his new method rather completely, and though these are practically the same as presently emphasized, we are listing them again for consideration. He points out that the essential disadvantage of the opaque enema lies in the use of a contrast mass which is impermeable to rays. For this reason, loops which are situated on top of each other cannot be distinguished. Tumors which project into the intestine are frequently blotted out and are visible only under certain favorable conditions. Ulcers are not shown.

Fischer states that the following diagnostic features of the combined method must be considered:

(1) The contour of the wall in regard to its course. Even if several loops are superimposed, the contours of the individual loops remain distinct and permit differentiation. (Fig. 5). (Positional anomalies.)

(2) The contour of the wall in regard to its regularity and lineation. Irregularities and more or less coarse spottiness indicate the adherence of the contrast particles to the rough surfaces of an ulcer. Abnormal lineation of the contours suggests adhesions and pericolic constrictions.

(3) The lines, ellipses, and circles due to the different projections of the contractions of the annular muscles. Intactness of these lines permits the exclusion of pathologic transformations at the site concerned. Continuation of the lines from one wall contour to another demonstrates that the contours in question belong together.

(4) Easy recognition of tumors, contrast crumbs adhering to rough or ulcerated mucosa, balls of fecal matter, and foreign bodies. Confusion of a tumor with a bone shadow which projects into the lumen

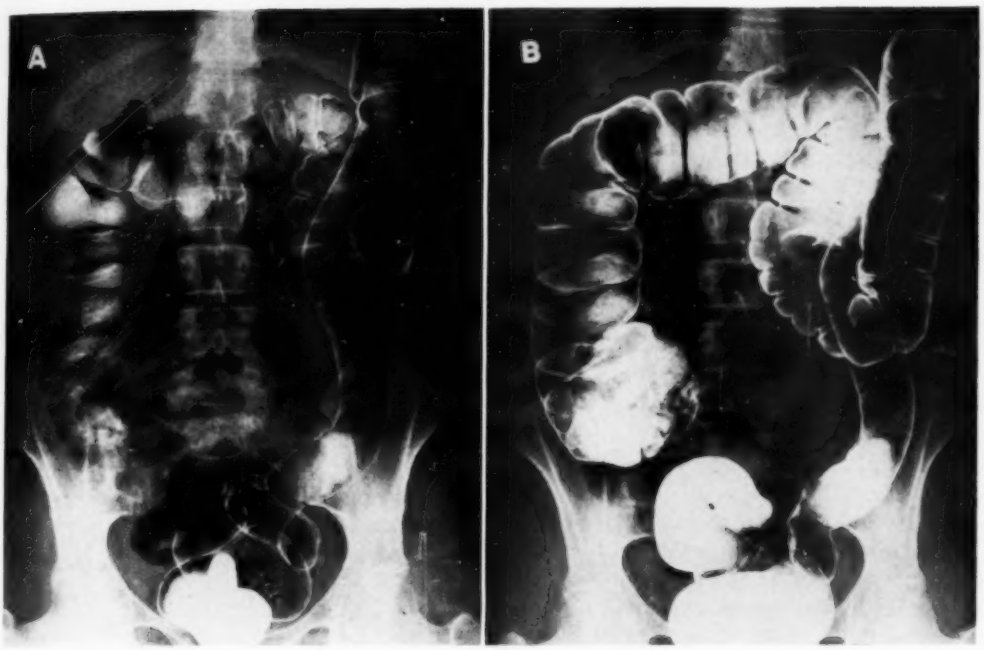

Fig. 7. A. Insufficient barium to visualize cecum and ascending colon adequately. B. Addition of barium permits a very satisfactory air study of the entire colon.

field must be avoided. (Shadows due to such causes we refer to as fictitious polyps—6.)

(5) The degree of expansibility of the colon.

(6) The distention produced by the filling with air and the positional change of mobile portions of the colon brought about in this manner as the patient's position is changed. From this one may draw conclusions regarding adhesions (Fig. 6).

Fischer further points out that the double-contrast method is superior to earlier ones in a number of respects. It is especially suited to bringing about progress in the early diagnosis of cancer of the large intestine, and can be an aid in all those cases in which obscure disturbances in the large intestine arouse suspicion of carcinoma. If, with this method, the physician in charge succeeds in distending the suspected portions of the intestine and showing them in the x-ray picture, he is in a position to guarantee the healthy condition of these parts; this is not possible with the older contrast passage or contrast infusion method.

DISCUSSION

With the adapter described above, it is possible to do a double-contrast study of the colon in a single stage. Since the necessity of removing part of the barium from the bowel either by evacuation or siphoning is eliminated, the time required for the examination is shortened by at least 50 per cent and the danger of barium drying on the bowel wall and leading to an unsatisfactory film is avoided. A single-stage examination adds, furthermore, to the comfort of the patient, who is often sore as a result of previous proctoscopy and preparatory purgatives and enemas. The possibility of resentment at having to undergo what he looks upon as two examinations is also obviated.

A further advantage lies in the fact that when it is found that insufficient barium

has been injected to coat the entire colon properly, the patient can be quickly turned to the left in Trendelenburg position and more barium slowly added. This will gravitate to the splenic flexure, and, on rolling the patient on his right side, will shift to the transverse colon. By leveling the table and then elevating the head of the table the barium will coat the ascending colon and cecum, thus making an otherwise unsatisfactory examination very acceptable (Fig. 7).

If a single means of examination were to be selected, we feel that careful fluoroscopy would be the most valuable. It is truly important in carrying out the method described. As previously stated, however, we feel that the ideal routine study of the colon should include the double-contrast enema, either as a supplement to the plain barium enema or as the primary examination. With the one-stage method only about as much time is required as for the usual opaque enema examination. The rotation of the patient from side to side is no more than is done in routine fluoroscopy in order to visualize the flexures. The only addition is tilting of the table to keep the barium column dependent.

Occasionally in the presence of a redundant sigmoid, the rectum and distal sigmoid may not be clearly visualized. Even though responsibility for diagnosis in this region belongs to the proctologist, roentgen study of these segments may be desired. We have tried several methods to visualize this area, such as (*a*) elevating the head of the table, siphoning the barium from the rectum and replacing it with air, or (*b*) letting the patient evacuate just a small amount, and then obtaining films. The former procedure was found to work in some instances, but was time-consuming and resulted in drying of the barium on the colon wall. The second method was satisfactory if the patient followed instructions, but frequently too much was evacuated, resulting in incomplete filling of the colon as well as drying in some instances. We found the most satisfactory method to consist in taking rotation films immediately after completing the examination and then allowing the patient to go to the toilet. As soon as he has relieved himself, another film is immediately made to demonstrate the sigmoid and rectum. In most cases these areas are well visualized. It was also found that, on evacuation, foreign material in the colon shifts, making this procedure a definite aid in differentiating fictitious polyps (6) and preventing the necessity of re-examination in some instances.

Since April 1, 1949, we have examined approximately 2,000 colons by this method. We have found that it takes practically no more time than routine fluoroscopy, and we are now using it in over 90 per cent of our examinations. It is our opinion that the added information thus derived is well worth while.

SUMMARY

In view of the numerous advantages of a double-contrast examination, a new and simplified method which can be completed in a single stage is described. This is carried out with the aid of a specially designed Y-shaped adapter, the two arms of which are attached respectively to the rubber tube leading to the enema can and a Weber insufflator, while the single end is attached to a Carman enema tip. The patient is prepared by thorough cleansing of the bowel, as for any colon examination. The barium is injected under fluoroscopic control and then, with the table tilted to a Trendelenburg position and the patient rotated to the left, the air is introduced. A high-kilovoltage, low-milliamperage-second technic is preferred for obtaining the films.

Fischer's analysis of the advantages of double-contrast examination is given.

NOTE: Our deep appreciation goes to Mr. LeRoy Winburne, head of the Photographic Department, for the excellent photographs which have been used in illustrating this and other of our papers.

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SUMARIO

Sencilla Técnica en un Tiempo para el Estudio en Doble Contraste del Colon

A la luz de las numerosas ventajas que posee el examen en doble contraste, descríbese una técnica nueva y simplificada que puede llevarse a cabo en un tiempo. Para ello se utiliza un adaptador *ad hoc* en Y, cuyos dos brazos van unidos respectivamente al tubo de caucho que conduce al depósito irrigador y a un insuflador de Weber en tanto que el otro extremo queda unido a la cánula de Carman para enemas. Se prepara al paciente con una limpieza escrupulosa del intestino, como para cualquier examen colónico. El bario es inyectado bajo fiscalización roentgenoscópica y luego, con la mesa inclinada a la posición de Trendelenburg y el enfermo rotado hacia la izquierda, se introduce el aire. Para la obtención de las radiografías, se prefiere una técnica de alto kilovoltaje, bajo miliamperaje-segundo. Aunque las películas estereoscópicas resultan convenientes, las radiografías aisladas en rotación son más valiosas que las vistas estereoscópicas en una sola posición.

La técnica no consume más tiempo que el examen corriente con enemas opacos y vale muy bien la pena la mayor información conseguida.

A Study of Pneumoencephalograms Before and After Prefrontal Lobotomy (Freeman-Watts Technic)[1]

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PREFRONTAL LEUKOTOMY as defined by Egas Moniz (1) consists in the destruction of "the more or less fixed arrangements of cellular connections which exist in the brain and particularly those which are related to the frontal lobes." This was first accomplished by the injection of alcohol into the subcortical prefrontal white matter. Later severance of these fibers was achieved by means of a hollow needle or "leukotome," or by a blunt dissector, as in Freeman and Watts technic (2). In the latter method the dissector was moved in the arc of a circle in a perfectly vertical plane anterior to the tip of the frontal horns of the ventricles immediately beneath the coronal sutures. Bleeding apparently was usually minimal.

METHOD OF STUDY

From May 21, 1947, to July 15, 1948, prefrontal leukotomies were done in 32 psychotic patients. In all but one of these pneumoencephalography was done prior to the operative procedure. The operations were performed by Dr. Robert Watson.[3] We were able to obtain preoperative pneumoencephalograms for 19 of the 32 patients. This was an unselected random sample dictated by feasibility alone.

It is our purpose in the present study to describe the pneumoencephalographic picture in these 19 unselected cases before prefrontal lobotomy and for variable periods of time up to twenty months following the surgical procedure, and to correlate our findings with autopsy observations made here and elsewhere.

Preoperative pneumoencephalography was usually performed several days preoperatively or at least within a period of eight weeks. In 5 cases, however, the interval prior to operation was three to nine months. The postoperative studies were done anywhere from four months to twenty months following prefrontal leukotomy, usually after one year or more.

The patients were all white males with the exception of one Negro male. Their ages ranged from 24 to 66 years, 7 being over 38 years of age. The duration of the psychosis exceeded three years except in one instance, in a 54-year-old white male who had a known psychosis for only nine months.

Although 11 of the patients received some form of shock therapy, in no instance was there any form of therapeutic procedure between the time of preoperative pneumoencephalography and the prefrontal leukotomy.

PNEUMOENCEPHALOGRAPHIC FINDINGS PRIOR TO PREFRONTAL LEUKOTOMY

In *9 of the patients*, the pneumoencephalographic findings prior to prefrontal leukotomy could be considered as normal or at the upper limits of normal. In 6 of this group the pneumoencephalograms were normal in every respect; in 3 the ventricu-

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lar measurements were at the upper limits of normal.

In *5 cases*, the ventricular system *per se* was normal, but there was an increase in the amount of air in the subarachnoid space surrounding the brain, accentuating the sulcal markings. In 2 of these 5 cases the increase was rather diffuse, whereas in the remaining 3 it showed a tendency to localization in the frontal regions.

In the remaining *5 cases* the following abnormalities were apparent on the preoperative pneumoencephalogram: in 1, a slight diffuse dilatation of the entire ventricular system, as well as an increase in the air around the cerebral cortex; in 1, a fairly considerable dilatation of the entire ventricular system, with no other manifestations of abnormality; in 2, a slight dilatation of the left lateral ventricle only, with increased sulcal markings overlying the left cerebral cortex; in 1, a questionable slight dilatation of the anterior horns of both lateral ventricles only. The pneumoencephalograms in these 5 cases were otherwise within normal limits.

Thus, approximately one-half of the "control" films were essentially normal in every respect, while the other half revealed evidence interpreted as indicating some measure of cortical atrophy or cerebral gliosis. One patient in this latter group also had a small area of calcification in the frontal lobe.

It is significant that in none of the cases were the sulcal markings absent nor did the subarachnoid space surrounding the brain appear to be obliterated.

PNEUMOENCEPHALOGRAPHIC FINDINGS AFTER PREFRONTAL LEUKOTOMY

For ease of comparison, the above grouping of cases will be followed in describing the postoperative findings.

In the group of *9 "normal" cases*, 4 showed definite but variable degrees of dilatation of all four ventricles, the dilatation usually being greatest in the anterior two-thirds of the lateral ventricles. There was also diffuse or almost diffuse apparent obliteration of the subarachnoid space overlying the cerebral cortex and between the cerebral hemispheres.

In 1 of the 9 "normal" cases ventriculograms were obtained rather than encephalograms, and the ventricles were found to be diffusely dilated. There was also a large porencephalic cyst occupying one frontal lobe. Evaluation of the subarachnoid space surrounding the cerebral cortex was not possible in this instance, since ventriculography ordinarily does not yield as much information in this respect as does pneumoencephalography.

In 3 of the 9 "normal" cases, the sulcal markings were virtually absent, but the ventricles remained normal in size and no other changes were noted.

In the last of the group, the sulcal markings were absent only in a 10-cm. circle around the burr holes, but no other changes were observed.

Of the *5 patients who had some increase in the sulcal markings and normal ventricles prior to operation*, 1 had a diffuse dilatation of the four ventricles, most marked in the anterior third of the lateral ventricles, and an obliteration of the sulcal markings in a 10-cm. circle around the burr holes.

One had a diffuse dilatation of all of the ventricles, most prominent in the anterior half of the lateral ventricles, diffuse obliteration of the sulcal markings, and small loculations of gas in the right frontal lobe suggesting several small porencephalic cysts.

In 1 the frontal horns of the lateral ventricles were dilated, the other ventricles remaining normal, and there was a diffuse obliteration of the sulcal markings, chiefly over the parietal and occipital lobes.

One had a dilatation of the right lateral ventricle posteriorly only, and obliteration of the sulcal markings around the burr holes.

In the last of these 5 cases two operations were done. Five months after the first operation the pneumoencephalograms showed dilatation of the left lateral ventricle only and a slight diffuse obliteration of sulcal markings overlying the cerebral cortex. Eleven months after the second operation and sixteen months after the first,

Fig. 1. J. B., a 55-year-old white male, was hospitalized with a diagnosis of "delusions with alcoholic psychosis." Pneumoencephalograms obtained on Nov. 12, 1947, showed a slight dilatation of the lateral ventricles and increased visualization of the sulci surrounding the brain, indicating slight diffuse cortical atrophy and gliosis. There was also a very slight bulbous dilatation, particularly in the anterior horns of the lateral ventricles, suggesting a mild to moderate degree of cortical gliosis or atrophy of the frontal lobes. See also Figs. 2 and 3.

Fig. 2. Pneumoencephalograms of patient shown in Fig. 1, obtained May 13, 1948, following prefrontal leukotomy on Jan. 13, 1948. Cortical atrophy and gliosis have increased, and there is evidence of a porencephalic cyst in the left frontal lobe. There was at this time relative absence of gas in the subarachnoid space and sulci surrounding the brain and posterior to the burr holes. See also Fig. 3.

there were progressive dilatation involving both lateral ventricles and an increased obliteration of the sulcal markings diffusely (Fig. 1).

Of the *2 patients who had slight dilatation of the left lateral ventricle only, preoperatively, and increased sulcal markings,* 1 showed a diffuse dilatation of the lateral ventricles more marked on the left, with a large left frontal porencephalic cyst and a diffuse diminution in the sulcal markings. The other showed essentially the same findings, but the porencephalic cyst in this instance measured 6 × 4 cm. The obliteration of

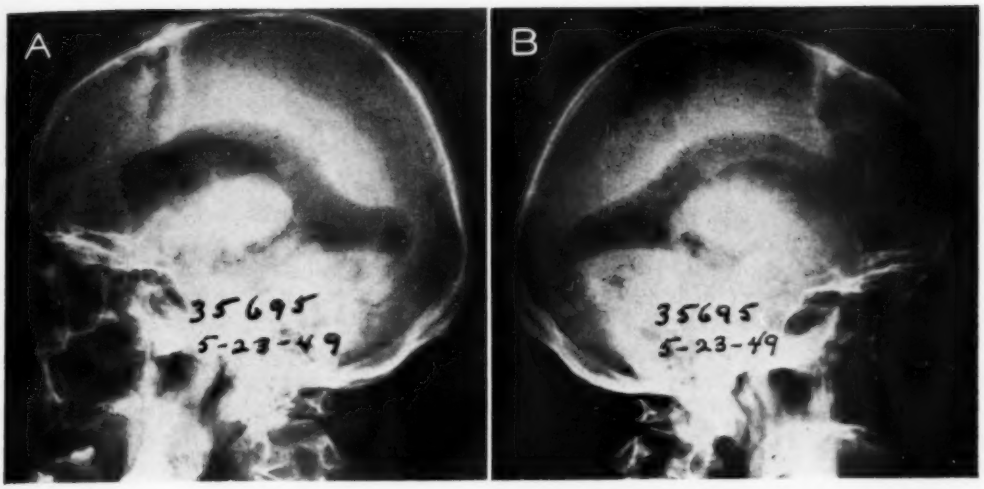

Fig. 3. A, B, and C. Pneumoencephalograms of the patient shown in Figs. 1 and 2, obtained on May 23, 1949, revealing a progressively increasing cortical atrophy involving the entire brain diffusely, with a multiloculated porencephalic cyst particularly in the left frontal lobe. The relative absence of air in the subarachnoid space surrounding the brain is also noteworthy.

the sulcal markings was of considerably greater degree, but there seemed to be an increased visualization of the basal cisterns.

The patient who preoperatively had a slight diffuse dilatation of the entire ventricular system, as well as increased air in the sulcal markings around the cortex, had two pneumoencephalograms postoperatively. Four months after the operation, an increased dilatation of all the ventricles was demonstrable, greater on the left. There were also a left frontal porencephalic cyst, obliteration of the sulcal markings posterior to the burr holes, and a "puddling" of the sulcal markings over the frontal lobes. Sixteen months after the operation and twelve months after the previous study, a marked progression of all of the above findings was apparent.

In *the patient who had considerable dilatation of the ventricles preoperatively with no other detectable abnormalities* there was a further increase in the size of all of the ventricles, particularly the lateral; also, a left frontal porencephalic cyst measuring 6 × 3 cm., with no changes in the appearance of the sulcal markings.

The patient who had a questionable slight dilatation of the anterior horns of both lateral ventricles preoperatively and a small area of calcification in the right frontal lobe showed the least change of all, namely a very slight dilatation involving only the anterior horns

of the lateral ventricles and an increase in the sulcal markings of the frontal cortex and anterior half of the parietal lobes.

In summary, there were significant pneumoencephalographic changes in all of the cases regardless of the preoperative findings. Progressive dilatation of all of the ventricles, frequently most marked in the anterior portions of the lateral ventricles, and progressive apparent obliteration of the subarachnoid space surrounding the cerebral cortex seemed to be the most prevalent findings. In addition, porencephalic cysts developed in 5 cases (and possibly in a sixth). In only one of this number had a completely normal pneumoencephalogram been obtained preoperatively. In the other 4 cases the ventricles were dilated preoperatively, and hence the anterior horn of the lateral ventricle was very likely penetrated by the operative procedure.

CORRELATION OF AUTOPSY OBSERVATIONS WITH PNEUMOENCEPHALOGRAPHIC FINDINGS

Autopsy findings at various intervals following prefrontal leukotomy have been reported as follows: 2 cases by Watts and Freeman (3); 1 by Greenwood (4); 8 by Meyer, Beck, and McLardy (5); 9 by Meyer, Bond, and Beck (6).

Of a total of 85 patients in whom prefrontal leukotomies were done in this hospital between Oct. 25, 1945, and May 22, 1949, 7 have died, and on 6 autopsies have been performed. Unfortunately, 3 of these patients also had syphilis of the central nervous system, which complicated the pathologic findings in the meninges and brain. However, one may probably summarize the autopsy findings from all of these cases and those reported as follows:

There is a variable thickening of the arachnoid, with grayish discoloration and opacity in most cases. The cerebral cortex is usually thinned, with a widening of the sulci and narrowing of the gyri. There may be multiple areas of softening in the gyri. There is usually slight to moderate dilatation of the ventricular system. Associated porencephalic cyst formation is of frequent occurrence, with marked degenerative changes in the white matter of the frontal lobe.

Degeneration of the nucleus medialis dorsalis of the thalamus and degenerative changes in the basal ganglia are almost invariably observed, and it is possible that these latter changes are of paramount clinical importance.

In correlation with these findings, there is almost universal disappearance or absence of air in the subarachnoid space surrounding the cerebral cortex as demonstrated on the pneumoencephalograms. This would suggest one or both of two possibilities: (1) a relatively marked obliteration of the subarachnoid space over the cerebral hemisphere as the result of prefrontal leukotomy or (2) obliteration of the communicating channel between the basal cisterns and the subarachnoid space overlying the outer cerebral cortex. Either of these phenomena would impede or hinder the absorption of the cerebral spinal fluid by the arachnoidal granulations. This in turn would cause a variable degree of external hydrocephalus. The associated contraction from surgical injury in the frontal lobe would produce the increased effect on the frontal horns of the lateral ventricles indicated by selective dilatation of this portion of the ventricular system apparent on the pneumoencephalograms.

These findings are also correlated with the pathologic evidence of cortical atrophy, sulcal widening, and gyral flattening, which likewise would indicate some measure of cortical and cerebral atrophy. These changes may be progressive, as was indicated by serial studies performed in 2 cases following operation.

SUMMARY AND CONCLUSIONS

(1) Pneumoencephalographic studies were made in 19 psychotic patients of various ages before and after the performance of leukotomy according to the Freeman-Watts technic. The preoperative pneumoencephalograms were for the most part obtained shortly before leukotomy;

the postoperative studies up to twenty months following the operation.

(2) In 9 patients the preoperative findings were normal. Postoperatively, 5 of these 9 showed diffuse dilatation of the ventricles and in all of the 9 there was a significant absence of air in the subarachnoid space surrounding the brain. In 1 case a large porencephalic cyst developed, occupying almost all of one frontal lobe.

In 5 cases the ventricles appeared normal preoperatively but there was an increase in the sulcal markings. Postoperatively these patients also showed progressive dilatation of the ventricles with obliteration of the subarachnoid space surrounding the brain. In one instance, also, a porencephalic cyst developed.

In the remaining 5 cases studied preoperatively there was a diffuse or localized ventricular dilatation. Postoperatively 4 of these showed frontal porencephalic cysts, progressive ventricular dilatation, and obliteration of the subarachnoid space surrounding the brain.

(3) Related pathological findings in 5 of 7 autopsied cases included: (*a*) cystic necrosis of the frontal lobes; (*b*) atrophy and gliosis throughout the brain; (*c*) meningeal thickening, scarring, and hemorrhages; (*d*) generalized enlargement of the ventricles most prominent in the frontal horns; (*e*) cystic degeneration of the thalamus and basal ganglia particularly in the nucleus medialis dorsalis of the thalamus.

(4) The hydrocephalus described as a radiographic finding is probably due to a combination of cerebral gliosis and atrophy and a diminution of the absorptive function of the arachnoidal granulations. It may also be related, to some extent, to obstruction to the free egress of spinal fluid between the basal cisterns and the subarachnoid space overlying the brain.

(5) Porencephalic cysts occurred with greater frequency in those cases which showed dilatation of the anterior horns of the lateral ventricles preoperatively either as a localized dilatation or as a part of a generalized enlargement of the ventricular system. It is believed that this can be explained by the fact that the anterior horns of the dilated ventricles are more easily penetrated by the leukotome at operation.

These findings are consistent with other cases reported in the literature.

To prevent the postoperative occurrence of porencephalic cysts, we suggest that pneumoencephalographic examination be included in the preoperative study in all prefrontal leukotomy cases. In those cases which show frontal horn ventricular dilatation, the surgical technic should be modified accordingly.

ACKNOWLEDGMENT: The authors are indebted to Dr. Robert Watson, neurosurgical consultant, for permission to utilize the operative reports in this series of cases; also to Drs. E. Lloyd Wilbur and Robert A. Burger, pathologists, and Dr. Anderson Nettleship, consultant in pathology, for permission to utilize the necropsy findings described herein.

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(Para el sumario en español, véase la página siguiente.)

SUMARIO

Estudio de los Neumoencefalogramas Antes y Después de la Lobotomía Prefrontal (Técnica de Freeman-Watts)

En 19 psicópatas de varias edades, ejecutáronse estudios neumoencefalográficos antes y después de verificar una leucotomía conforme a la técnica de Freeman-Watts. Los neumoencefalogramas preoperatorios fueron tomados en su mayor parte poco antes de la operación; los estudios postoperatorios continuaron hasta veinte meses después de la misma.

En 9 enfermos los hallazgos preoperatorios fueron normales. Postoperatoriamente, 5 de los 9 mostraron dilatación difusa de los ventrículos y en todos los 9 había significativa ausencia de aire en el espacio subaracnoideo circundando el cerebro. En 1 caso, se formó un gran quiste porencefálico que casi llenaba un lóbulo frontal.

En 5 casos los ventrículos parecían normales postoperatoriamente, pero estaban acentuadas las marcas de los surcos. Postoperatoriamente, esos enfermos revelaron además dilatación progresiva de los ventrículos con obliteración del espacio subaracnoideo que circundaba el cerebro. En un caso, también se formó un quiste porencefálico.

En los otros 5 casos había dilatación ventricular difusa o localizada antes de operación. Postoperatoriamente, 4 de ellos mostraron quistes fronto-porencefálicos, dilatación ventricular progresiva y obliteración del espacio subaracnoideo que circundaba el cerebro.

Los hallazgos patológicos pertinentes en 5 de los 7 casos autopsiados comprendieron: (*a*) necrosis quística de los lóbulos frontales; (*b*) atrofia y gliosis por todo el cerebro; (*c*) espesamiento, cicatrices y hemorragias en las meninges; (*d*) hipertrofia generalizada de los ventrículos, sobre todo en los cuernos frontales; (*e*) degeneración quística del tálamo y de los ganglios basales, en particular en el núcleo medial dorsal del tálamo.

La hidrocefalia descrita como hallazgo radiográfico se debe probablemente a una combinación de atrofia y gliosis cerebrales y disminución de la función absorbente de las granulaciones aracnoideas. Puede también estar relacionada, hasta cierto punto con la libre salida de líquido raquídeo entre las cisternas basales y el espacio subaracnoideo sobrepuesto al cerebro.

Los quistes porencefálicos alcanzaron su mayor frecuencia en los casos que revelaban preoperatoriamente dilatación de los cuernos anteriores de los ventrículos laterales, bien en forma de dilatación localizada o como parte de una hipertrofia generalizada del aparato ventricular. Parece que la explicación reside en el hecho de que los cuernos anteriores de los ventrículos dilatados son más susceptibles de penetración por el leucótomo al operar.

Estos hallazgos resultan compatibles con los obtenidos en otros casos comunicados en la literatura.

Opinan los AA. que el examen neumoencefalográfico debe figurar en el estudio preoperatorio de todos los casos de leucotomía prefrontal. En los que revelen dilatación ventricular de los cuernos frontales, la técnica quirúrgica debe ser modificada según proceda.

The Use of Photographic Films for Monitoring Stray X-Rays and Gamma Rays

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IN RECENT YEARS, particularly in the atomic-energy project, photographic films have been used extensively to monitor exposures to stray radiation received by personnel. Frequently, films are employed in conjunction with pocket ionization meters, each serving as a check upon the other. The most significant difference between the two methods is that a properly calibrated ionization meter records roentgens directly over a wide range of x-ray qualities, while the film response, in terms of roentgens, varies greatly over certain quality ranges.

Other differences between the two methods are that an ionization recording can be evaluated immediately after the exposure, whereas the films must first be processed; the films will integrate the exposure satisfactorily over a period of several weeks, while the ionization measurement is best limited to an exposure of one day. Contamination of the insulation in the pocket meter, or mechanical shock, may result in an electrical discharge of the device independently of any exposure to radiation, thereby producing an excessive reading. A simultaneous film recording will act as a check against this possibility. The film also provides a long-lasting direct record of the exposure.

By themselves, photographic films cannot give a measurement of the quantity of radiation. They must be suitably calibrated so that the densities observed on the monitoring films can be evaluated in terms of roentgens. Ordinarily, some films of the same emulsion number as the films worn by personnel are given a known exposure, or a series of exposures, expressed in roentgens, to primary radiation of suitable quality. These calibration films are processed with the monitoring films, and the exposures on the latter are evaluated by comparing their densities with those of the calibration films. If calibration films are developed with each batch of monitoring films, a high degree of constancy of the development conditions is not essential, although it is desirable to maintain uniform recommended temperatures and other properly controlled developing conditions.

The value of the calibration exposure may be made equal to the maximum tolerance dose for the period during which the monitoring films were carried by the personnel. By comparison of the resulting densities, it can be determined whether the monitoring films received more or less than the tolerance exposure.

Another possibility is to give the calibration films a series of known exposures. By comparison of the film densities, the values of the actual exposures of the test films can be determined. A simple visual comparison is sufficient for qualitative determination, but if greater precision is desired, and if the actual exposures are to be recorded and permanent exposure records maintained, the film densities should be read on a densitometer. The densities of the calibration films can be plotted against the exposure in roentgens, and the densities of the monitoring films can be evaluated in roentgens by reference to this curve.

As a rule, the films carried by personnel are exposed to stray radiation, whereas calibration films are most conveniently exposed to primary radiation. Ideally, the calibrating radiation should be of the same quality as the stray radiation to which the monitoring films were exposed. Usu-

[1] Communication No. 1384 from the Kodak Research Laboratories, Kodak Park Works, Rochester, N. Y. Presented by the author at the Thirty-fifth Annual Meeting of the Radiological Society of North America, Cleveland, Ohio, Dec. 4–9, 1949.

ally, this is not practicable, and the problem is, therefore, to determine suitable calibrating radiations for the various conditions under which monitoring films are likely to be used. The choice of calibrating radiation is governed both by the quality of the stray radiation and by the relation between the photographic and ionization responses to these radiations.

In the National Bureau of Standards Handbook 41 on "Medical X-Ray Protection up to Two Million Volts" (4), stray radiation is defined as "radiation not serving any useful purpose. It includes direct radiation and secondary radiation from irradiated objects." The principal sources of stray x-rays are direct radiation transmitted by the protective housing of the x-ray tube and secondary radiation from the patient or subject under exposure. These radiations, in turn, strike other near-by objects and give rise to further stray radiation. In the case of work with radioisotopes, the external exposures are attributable both to direct radiation and to radiation scattered from shields and equipment.

In this paper, only the useful results of the investigation are presented. An account of the experimental procedures will be offered in a later report.

VARIATION OF FILM SENSITIVITY WITH RADIATION QUALITY

A typical example of the way in which film response, in terms of the roentgens required to produce a density of 1.0, varies with x-ray tube voltage is illustrated in the curves of Figure 1 for Kodak Blue Brand Medical X-Ray Film. The filtrations applying to the two curves are listed in Table I. Other film types show a similar trend, but the relative sensitivities may differ somewhat from those shown in Figure 1.

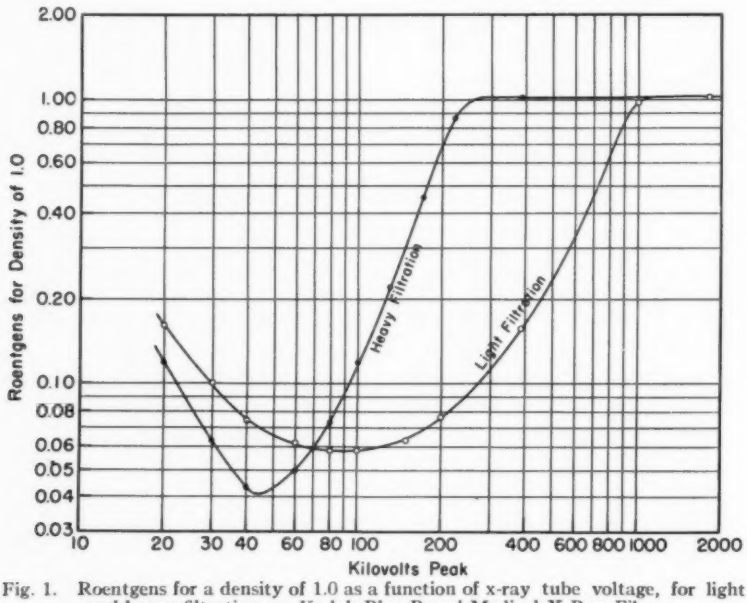

Fig. 1. Roentgens for a density of 1.0 as a function of x-ray tube voltage, for light and heavy filtration, on Kodak Blue Brand Medical X-Ray Film.

From 100 to nearly 1,000 kv. there is a marked divergence in film sensitivity between lightly and heavily filtered radiations. Thus, in this range, the film response will be quite different for radiation transmitted through a protective barrier and radiation with little or no filtration.

For lightly filtered radiation in the range 60 to 140 kv., film sensitivity does not vary

TABLE I

1	2	3	4	5
Kilovolts	Inherent Filtration, (mm.)	Added Filter		Effective Photon Energy for Heavy Filtration (Mev_{eff})*
		Light Filtration, (mm.)	Heavy Filtration, (mm.)	
20	0.5 Al	0	0.05 Cu	0.016
30	0.5 Al	0.5 Al	0.15 Cu	0.026
40	0.5 Al	1.0 Al	0.4 Cu	0.033
60	0.5 Al	1.0 Al	1.0 Cu	0.045
80	0.5 Al	1.0 Al	2.25 Cu	0.060
100	0.5 Al	1.0 Al	4.0 Cu	0.075
130	4.0 Al	...	5.0 Cu	0.089
150	4.0 Al	0	...	...
170	4.0 Al	...	9.0 Cu	0.116
200	4.0 Al	0	...	...
220	4.0 Al	...	14.0 Cu	0.139
385	1.1 Cu	0	1.5 Pb	0.2*
1,000	1/8 in. W + 1/8 in. Brass	0	...	...
Ra gamma rays	10 Al around Ra	0.5 Cu over film	...	...

* At each filtration of column 4, effective wave length was determined from the copper absorption curve, and from this value effective photon energy was computed.

over 10 per cent. In this range, films calibrated with any one radiation will record any of the other radiations nearly correctly. This is true, also, for the general radiations from 1,000 to 2,000 kv., where the film sensitivity is practically constant.

For lightly filtered radiation from 140 to 1,000 kv., the film sensitivity changes markedly. Films calibrated with any one radiation will record accurately only radiation of the same quality. As a rule, the exact quality of the stray radiation will not be known, so that it will not be possible to choose an equivalent primary radiation for purposes of calibration. In this range, therefore, accurate film measurements of stray radiation cannot be expected, and the calibrating radiation must be so chosen as to avoid any material under-valuation of the stray radiation, although considerable over-valuation may sometimes occur. Some degree of over-valuation is not seriously objectionable, since it operates in the direction of increased safety. In general, this means that the calibrating radiation must be either of the same quality as, or harder than, the stray radiation. The quality of the stray radiation may vary greatly according to whether it is secondary radiation from the subject under exposure or radiation passing through a protective barrier. If both types are present, it is important to know something about the relative intensity of each.

The sensitivity of the film is substantially constant for most angles at which the radiation strikes it. The response falls off materially only for radiation making angles of less than 10 degrees with the plane of the film. This falling-off in apparent sensitivity under these conditions is due to self-shielding of the film.

FILM MONITORING IN DIAGNOSTIC RADIOLOGY

In diagnostic radiology, as shown by Braestrup (2), the stray radiation is largely scattered radiation originating in the patient. The intensity of the direct stray radiation emerging through the housing of the customary ray-proof tube is usually small compared to scatter from the patient, and, furthermore, the radiation transmitted by the lead lining recommended for room walls or protective shields is generally small compared to the scattered radiation reaching the same area. In diagnostic radiology, therefore, film monitoring is directed toward the scattered radiation, the quality of which is substan-

TABLE II: FILM SENSITIVITY RANGES FOR LIGHTLY FILTERED 100-KV. X-RAYS

Film	Code	Approximate Roentgens for Density of				
		0.2 + Fog	1	2	3	4
Kodak Industrial X-Ray Film, Type K	5135	0.005	0.02	0.05	0.10	0.18
Kodak Super-Speed Occlusal Dental X-Ray Film	DF-45	0.01	0.05	0.02	0.8	...
Kodak No-Screen Medical X-Ray Film	5133	0.005	0.02	0.05	0.09	0.15
Kodak Blue Brand Medical X-Ray Film	5121	0.01	0.06	0.2	0.8	...
Kodak Ultra-Speed Periapical Dental X-Ray Film	DF-58	0.03	0.15	0.3	0.5	0.7
Kodak Industrial X-Ray Film, Type A	5160	0.03	0.15	0.3	0.5	0.7
Kodak Rapid Processing Periapical Dental X-Ray Film	DF-65	0.05	0.25	0.6	1.0	1.6
Kodak Radia-Tized Periapical Dental X-Ray Film	DF-7	0.1	0.5	1.1	1.8	2.7
Kodak Regular Periapical Dental X-Ray Film	DF-19	0.2	1.0	2.4	5	12
Eastman Fine Grain Release Positive Film, Type 7302 (16 mm. Safety)	7302	1.0	4.4	10	18	34

Note: Above values apply to five minutes development in Kodak Rapid X-Ray Developer at 68 °F. Values in the last four columns apply to the respective densities with fog included.

tially similar to that of the primary radiation. In exposing the calibration films, the tube voltage most commonly used in the diagnostic examinations is to be preferred, but the exact value is not important, so long as it lies within the diagnostic range.

If monitoring films are to be carried for a period of about a week, the best choices are Kodak Radia-Tized Periapical Dental or Kodak Rapid Processing Periapical Dental X-Ray Films (Table II). Full development should be given both films: five minutes in Kodak Rapid X-Ray Developer at 68° F., or the equivalent.

To give the dental packet greater mechanical protection, it may be enclosed in a small paper envelope, such as a coin envelope.

For the measurement of the exposures used in calibrating the films, ionization meters of the type designed for stray radiation are generally to be preferred. The exposure times for the ionization chamber and the film may have to be different, as, for example, when 0.3 r is to be applied to the calibration films and 0.2 r is the limit of the scale of the ionization meter. For constant conditions of operation of the x-ray generator, the value of the exposure in roentgens is proportional to the exposure time.

FILM MONITORING IN 220-KV. THERAPY

For therapeutic installations operating up to 250 kv., the National Bureau of Standards Handbook 41 requires substantially that the therapy room be completely enclosed in a protective barrier, except in directions where distance alone is sufficient to provide protection of the nearest occupied space. With complete protective enclosure of the room according to the required standards, there should normally be no occasion for monitoring the radiation transmitted through the barrier, but if such monitoring appears necessary, the calibration films should be exposed to heavily filtered radiation. The heavy filtration values of Table I furnish a guide to the selection of filter thickness to permit convenient exposure conditions. The choice of film would be similar to that for gamma rays. Kodak Industrial X-Ray Film, Type K, in dental packets, or Kodak Super-Speed Occlusal Dental X-Ray Films would normally be preferred (Table III).

Where distance alone is relied upon for protection, and it is desired to monitor the personnel or area in question, or if circum-

TABLE III: FILM SENSITIVITY RANGES FOR GAMMA RAYS OF RADIUM

Film	Code	Approximate Roentgens for Density of				
		0.2 + fog	1	2	3	4
Kodak Industrial X-Ray Film, Type K	5135	0.13	0.5	1.3	2.5	5
Kodak Super-Speed Occlusal Dental X-Ray Film	DF-45					
Front Film		0.15	0.7	2.4	8	...
Back Film		0.13	0.6	2.0	7	...
Kodak No-Screen Medical X-Ray Film	5133	0.17	0.7	1.7	3	5
Kodak Blue Brand Medical X-Ray Film	5121	0.2	1	3.4	12	...
Kodak Ultra-Speed Periapical Dental X-Ray Film	DF-58	0.4	2	4	7	10
Kodak Industrial X-Ray Film, Type A	5160	0.7	3	6	10	14
Kodak Rapid Processing Periapical Dental X-Ray Film	DF-65	0.6	3	7	12	20
Kodak Radia-Tized Periapical Dental X-Ray Film	DF-7	1.3	6	13	20	32
Kodak Regular Periapical Dental X-Ray Film	DF-19	3	13	30	65	160
Eastman Fine Grain Release Positive Film, Type 7302 (16 mm. Safety)	7302	22	100	225	400	750

Note: Above values apply to five minutes development in Kodak Rapid X-Ray Developer at 68° F. Values in the last four columns apply to the respective densities with fog included. During the exposure, the face of the film was covered with a filter of 0.5 mm. Cu to absorb externally generated electrons.

stances are such that stray radiation can get around a protective barrier, the quality of the stray radiation is governed primarily by that emitted from the patient and the x-ray tube.

In x-ray therapy at 220 kv., scatter from the patient is softer than the primary radiation. Films calibrated with primary radiation will over-value radiation scattered at 90 degrees by a factor as high as 2. However, the scatter may or may not predominate over the direct stray radiation, depending upon the x-ray tube current, the filtration of the primary beam, the protective value of the tube housing, the direction of the scatter from the patient, and the size of the field irradiated.

The protective value of the tube housing may differ according to whether it follows the older specifications of the National Bureau of Standards Handbook HB20 on X-Ray Protection (5), or the newer National Bureau of Standards Handbook 41. The latter permits somewhat less protection in the tube housing under most conditions.

The older protective specifications called for a 5 mm. lead equivalent for the housing of a 225-kv. x-ray tube. Tests were made on the intensity of scatter from a water phantom exposed to 220-kv. x-rays filtered by 1.0 mm. of copper. For field sizes of 100 sq. cm. or greater, the scatter at 1 meter from the center of the phantom was found to be two or more times the intensity of the primary radiation through 5.0 mm. of lead. If we consider only the scatter at angles of 90 degrees or more, the film is found to over-value it by a factor greater than 2. In such a case, if the intensity of scattered radiation is at least equal to that of the direct stray radiation, the two radiations combined will still be fully evaluated, if not over-valued, by the film. In general, with the older standard of tube protection, it can be concluded that, at 220 kv. with 1.0 mm. Cu filtration, films calibrated with the primary radiation will fully evaluate, or over-value, the stray radiation for field sizes of 100 sq. cm. or larger.

The new standard of built-in tube protection for therapy tubes, as specified in N. B. S. Handbook 41, permits a maximum of 1 r per hour of direct stray radiation when the tube is operating continuously at its maximum rated current for the maxi-

mum rated voltage. For a current rating of 10 ma., this specification is equivalent to 1.67 mr/ma.-min. at 1 meter, which is several times as large as that allowed by the old standard. To make the new standard equivalent to the old, the current rating of the tube would have to be 35 ma. or more.

With the older standard, an x-ray tube designed for a given voltage would have a fixed value of built-in protection regardless of its milliamperage rating. Under a given set of exposure or treatment conditions, the ratio of direct stray to scattered radiation would *not* depend on the current rating of the tube. With the new standard, the degree of built-in tube protection does depend upon the current rating, and so does the ratio of direct stray to scattered radiation. This complicates the choice of film calibration conditions with x-ray tubes built under the new standard. Studies of the radiation scattered from a water phantom under exposure to x-rays at 220 kv. indicated that films calibrated with the primary radiation would not under-value the total stray radiation, provided that the treatment conditions met the following requirements:

1. The x-ray tube is operated at its maximum rated voltage and at the maximum current rating for this voltage.
2. The maximum current rating for the maximum rated voltage is at least 10 ma.
3. The tube filtration is at least 1 mm. copper.
4. The size of the irradiated field is 100 sq. cm. or greater.
5. The radiation intensity at the skin is approximately 30 r/min. (in air) or greater.
6. The angle of scatter is 90 degrees or greater, as measured from the forward direction of the primary beam.

Above 220 kv., the scatter would increase somewhat, while direct stray radiation must be kept within the same limit, so that the above requirements will still apply. X-ray output data at 200 kv. and 0.5 mm. or less of Cu filtration indicate that the above requirements are valid for this exposure condition also. Higher filtrations than 0.5 mm. Cu at 200 kv., or 1.0 mm. Cu at 220 to 250 kv., will lessen the intensity of scattered radiation in relation to direct stray radiation and will therefore cast doubt on whether the scatter or the direct stray radiation is the more intense. In such cases, the only safe procedure is to calibrate the films by heavily filtered primary radiation.

If the situation in 220-kv. therapy is such that the predominant stray radiation consists of scatter from the patient, the most suitable choice of monitoring film would be Kodak Rapid Processing Periapical Dental X-Ray Film or Kodak Ultra-Speed Periapical Dental X-Ray Film (Table II).

If scatter from the patient is reduced below that resulting from the above conditions, it may be exceeded by the direct stray radiation, and the monitoring films should be calibrated with heavily filtered primary radiation (see Table I, column 4). In this case, the monitoring films may indicate too high a value for the total stray radiation exposure.

FILM MONITORING WITH 1,000–2,000-KV. X-RAYS OR RADIUM GAMMA RAYS

Normally, x-ray generators operating at 1,000 to 2,000 kv. are enclosed completely in a protective barrier, and radiation safety tests would be applied only to radiation transmitted by the barrier. Film sensitivity is approximately constant in this voltage range, and the films could be calibrated either with the primary radiation from the x-ray tube or with the gamma rays of radium. In the latter case, no ionization measurement is necessary, since the gamma-ray output per milligram of radium is known to be 0.84 milliroentgen per hour at a distance of 1 meter when the radium is enclosed in a platinum container with a wall thickness of 0.5 mm.

In an "open" installation, where distance alone is relied upon for protection, it is still generally advisable to calibrate the monitoring films with the primary radiation or the gamma rays of radium. For therapeutic x-ray generators operating in the range 251 to 2,000 kv., National

Bureau of Standards Handbook 41 provides that direct stray radiation shall not exceed 1 roentgen per hour at 1 meter from the tube target. With a 1,000-kv. resonance type generator, Braestrup and Wyckoff (3) found scattered radiation from a phantom to be of this same order. X-rays scattered from metals are of even lower intensity, so that, in general, the direct stray radiation at 1,000 kv. will predominate over the scattered radiation. Therefore, the film calibration conditions should be directed toward the direct stray radiation.

When only the forward beam from the 1,000-kv. resonance type generator is employed, the lateral direct stray radiation may be largely absorbed by a lead sleeve mounted over the target portion of the tube. Braestrup and Wyckoff found that such a sleeve reduced the direct stray radiation to the same order as the scattered radiation from a phantom.

When exposed to x-rays at 1,000 to 2,000 kv., or to the gamma rays of radium, all materials emit, in addition to the scattered radiation, appreciable amounts of electrons. Under some conditions, the electrons may produce several times as much ionization or photographic action as the primary x-rays. If it is desired to record only the x-rays (or gamma rays), an absorbing filter should be mounted over the face of the film packet. Tests have shown that for 1,000-kv. x-rays, 1.0 mm. of aluminum is adequate; 0.5 mm. of copper or brass is recommended for 2,000-kv. x-rays or for the gamma rays of radium.

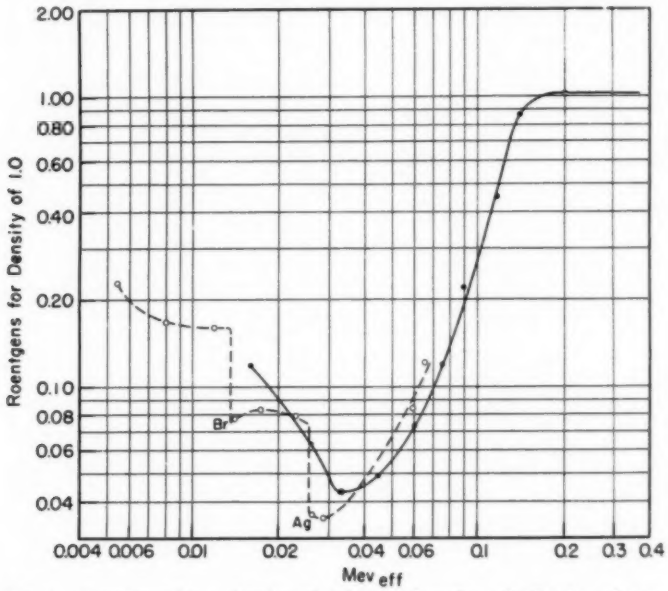

Fig. 2. Roentgens for a density of 1.0 as a function of effective photon energy (mev_{eff}) on Kodak Blue Brand Medical X-Ray Film.

The same filter for the film should be employed in the calibration exposures.

CADMIUM FILTRATION OVER THE FILM

For the radiations represented by the heavy filtration curve of Figure 1, effective wave lengths were determined and the corresponding effective photon energies in million-electron-volts (mev) were computed (last column, Table I). The roentgens required to produce a density of 1.0 were plotted against effective photon energy (Fig. 2, solid line). The dotted curve shows results computed from observations made by H. E. Seemann in the same manner as given in his paper on spectral

sensitivity of commercial films (8). The exposures were made with substantially mono-energetic radiation in the form of fluorescent x-rays from various chemical elements. The dotted curve (Fig. 2) shows the sudden changes in film sensitivity occurring at the K critical absorption limits of silver and bromine, and indicates that the course of the solid curve in the range 0.016 to 0.033 mev is due largely to these absorption changes within the AgBr of the photographic emulsion. Above 0.04 mev, the two curves run close to each other, the divergence arising from the fact that the filtered general radiation is not a sufficiently close approximation to mono-energetic radiation.

It is logical to consider whether a suitable filter over the film would reduce the response at energies below 0.2 mev to that above 0.2 mev.

In the U. S. Atomic Energy Commission Report MDDC-1065 (Photographic Film as a Pocket Radiation Dosimeter), Pardue, Goldstein, and Wollan (6) describe a procedure whereby a filter of 1 mm. of cadmium plus 0.5 mm. of iron is mounted over each side of the film to absorb preferentially the lower-energy radiations and thereby to equalize the effective sensitivity of the film over a wider range of energies. The principal effect is due to the cadmium; the iron is included as part of the construction of the badge which carries the film. Pardue and his associates report that this filter-film assembly has practically uniform sensitivity over the range from 100-kv. x-rays to the gamma rays of radium.

In the present work, this use of cadmium filters over the film was studied on two types of x-ray film, Kodak Blue Brand and Kodak Type K, with exposures to the gamma rays of radium and to heavily filtered x-radiation from 60 to 220 kv. (0.045 mev to 0.139 mev). Various thicknesses of cadmium were tried with each type of film. The radiations were directed perpendicularly upon the film.[2]

With either film, no one thickness of cadmium gave equal film responses from the different radiations tested. With Blue Brand Film, the best choice of cadmium thickness appeared to be 1.1 mm., which gave approximately similar film responses for radiation energies of 0.075 mev (100-kv. x-rays filtered by 4.0 mm. Cu) and above (Fig. 3). The equivalent of 1.1 mm. cadmium would be closely approximated by 1.0 mm. cadmium plus a thin layer of iron or brass forming the front and back panels of a film badge.

With Type K Film, 1.85 mm. cadmium was found to give substantially similar film responses for energies of 0.089 mev (130-kv. x-rays filtered by 5.0 mm. Cu) and above (Fig. 3). A thickness of 1.0 mm. cadmium gave a considerable variation in film response, but for energies in the range 0.075 to 0.138 mev, the roentgen values for a density of 1.0 were less than for the gamma rays of radium, so that if the gamma radiation were used for calibrating the film, the exposures to the other radiations would be over-valued by factors ranging as high as 2.

These conclusions apply to radiation striking the film perpendicularly. Radiation at other angles will traverse a greater thickness of cadmium, and the exposure of the film will be correspondingly less.

Thus, the use of an effective absorber, such as cadmium, to hold the lower energy radiations to the same film response as that from the higher energies, necessarily results in a marked variation in the corresponding film response with the angle of the incident radiation. In the usual situation, where stray radiation may strike the film at almost any angle, the best way out of this difficulty is to use a thinner cadmium filter than would be selected for perpendicular radiation. Radiation energies in the range 0.089 to 0.139 mev. require about 1.85 mm. cadmium to reduce the effect on Type K Film to that from the gamma rays of radium. If a 1 mm. thickness of cadmium is used over the film, its effective thickness will be 1.85 mm. at an angle of 57 degrees from the perpendicular, and these radiations (0.089 to 0.139 mev) falling at

[2] Filtrations as recorded in Table I, column 4.

that angle will be evaluated about correctly. At lesser angles, these radiations will be over-valued, but this over-valuation is in the direction of increased safety.

It may be concluded, therefore, that by the use of suitable filters over the film, the lower energy limit for nearly uniform film response can be reduced from 0.2 mev to the neighborhood of 0.07 to 0.09 mev with radiation striking the film perpendicularly. By decreasing filter thickness, radiations over a range of angles can be recorded without under-valuation, but the radiations nearer the perpendicular will be over-valued. In general, of the two films tested with cadmium filtration, Type K appears to be the better choice. With 1 mm. cadmium on each side, this film will record x-rays (or gamma rays) of energy 0.09 mev or above, within an angle range of 57 degrees from the perpendicular, without under-valuation when calibrated with the gamma rays of radium.

In order to record softer radiations to which the cadmium-covered film is not sufficiently sensitive, Pardue and his associates left an opening in the film badge and included in the packet a second film, of slower speed, suitable for this purpose.

A combination of two films, one cadmium-covered and the other without a filter, either in the same or separate packets, should be quite useful in monitoring exposures to radiations of widely different energy, such as a combination of diagnostic x-rays and the gamma rays of radium. If the cadmium covers only part of the film, the resulting contrast between the two film areas will indicate whether radiations of much different penetrations have fallen on the film. If such is the case, the exposures in roentgens recorded by the cadmium-covered and the unfiltered films should be added, in order to include the total radiation received. Separate calibrations should be made for the cadmium-covered and the unfiltered film areas, and the choice of calibrating radiation for each will be determined by the quality of radiation affecting each of the two areas in the monitoring films. The unfiltered film is relatively insensitive to the harder radiations, above 0.2 mev or above 1,000-kv. general radiation, whereas the cadmium-covered film is relatively insensitive to the softer radiations, below 0.07 mev or below 150-kv. general radiation with low filtration. Therefore, if both radiations have

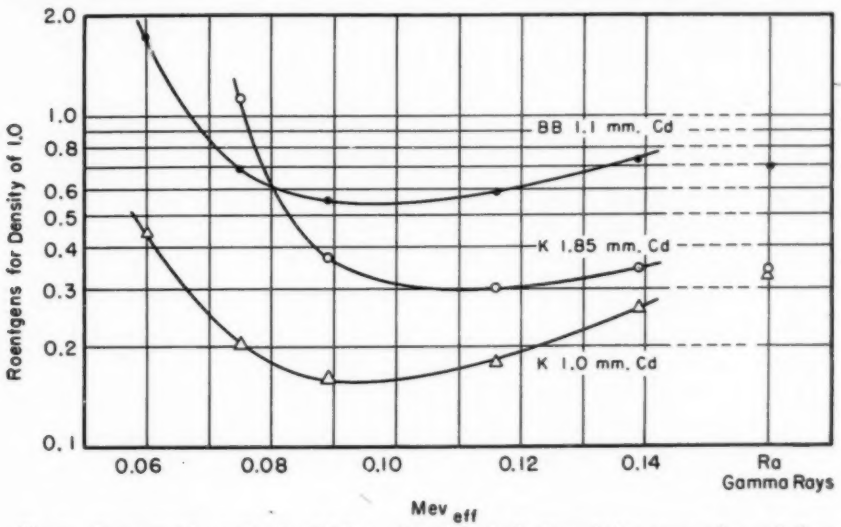

Fig. 3. Roentgens for a density of 1.0 as a function of effective photon energy for cadmium-covered films, Kodak Blue Brand Medical X-Ray Film (BB) and Kodak Industrial X-Ray Film, Type K (K).

been received, their photographic evaluations on the two films should be added, even if some of the intermediate radiations are over-valued by this procedure.

CHOICE OF FILM SENSITIVITIES

Normally, a monitoring film will be carried by personnel for a period of about a week, and if the film should receive the tolerance dose for this period, that should be indicated by a suitable density. A medium density of about 1.0 for the tolerance dose will permit estimation of considerable variations above and below this value. A film density of 1.0 is just sufficient to obscure newsprint when placed in contact with it.

Films may, of course, be carried for longer or shorter periods, as the occasion may require, or they may be used to estimate radiation exposures under experimental conditions that do not involve the subjection of personnel to the exposure in question. Thus, a wide range of film sensitivities may be needed to cover the principal applications of film monitoring or measurement.

To serve as a guide to the choice of film for different conditions, Tables II and III have been prepared, giving the approximate roentgens required to produce various film densities, with both 100-kv. x-rays and the gamma rays of radium, for a group of ten film types. The film data for 100 kv. will be applicable, in the main, to medical radiography and fluoroscopy and to x-ray therapy from 60 to 140 kv., with lightly filtered radiation, and also to industrial radiography in the range 60 to 140 kv.

The data for gamma rays will also apply to x-rays in the range 1,000 to 2,000 kv., and to heavily filtered lower-voltage x-rays down to 200 kv. Film sensitivity (r for D = 1.0) is not always the same for 1,000-kv. x-rays and the gamma rays from radium, but the difference is not particularly significant for the purposes of film monitoring. For other conditions, the curves of Figure 1 will assist in judging the changes in film sensitivity from the values of Tables II and III.

STRAY RADIATION IN THE RADIOGRAPHY OF METALS

Permanent installations for the radiography of metals should include a protective barrier completely surrounding the x-ray tube and the specimen. This is not always feasible, however, as in the case of mobile equipment used to radiograph parts in place, where they cannot be moved to the radiographic room. In this situation, temporary barriers and distance must be relied upon for the necessary protection, and monitoring of near-by personnel should be carried out to ensure their safety.

In general, the secondary radiation from metal is much less intense than that from water or tissue. The shape or orientation of a specimen may also greatly affect the intensity of secondary radiation. The secondary radiation cannot be depended upon to be more intense than the direct stray radiation and may be much less. For these reasons, the calibration of monitoring films should not generally be based on the quality of the secondary radiation, but rather on that of the direct stray radiation from the x-ray tube. In other words, at voltages under 1,000 kv., calibration exposures of the films should be made with heavily filtered primary radiation. The degree of filtration should be as high as possible, without requiring undue length of exposure to either the film or the ionization meter (see Table I, column 4).

In the range 1,000 to 2,000 kv., including the gamma rays of radium, filtration of the radiation does not materially affect the film sensitivity in terms of roentgens, so that, for calibration, filtration of the primary beam is unnecessary. Furthermore, the same film calibration can be applied either to the scattered rays or to radiation passing through a tube housing or protective barrier.

The secondary radiations from such metals as iron or brass include a soft fluorescent K radiation characteristic of the metal. Lead is commonly used as a masking material and its fluorescent L radiation is also quite soft. These soft

components form the predominant feature of the secondary radiations from these metals at voltages up to 220 kv. and above. They are not properly recorded by either film or conventional ionization meters. They are absorbed to a considerable extent in air, and, at distances of about 6 feet for iron, 10 feet for brass, and 25 feet for lead, the proportion of these soft secondaries becomes small. Because of their low penetration into the human body, their effects will necessarily differ more or less from those of more penetrating radiations, but until more is known of their hazards, they should be guarded against. In open installations, the air path to the nearest personnel should be sufficient to absorb most of the fluorescent radiations, and the failure of monitoring methods to evaluate them properly will be of no consequence.

In exposures of metals to x-rays at 1,000 to 2,000 kv., or to the gamma rays of radium, electron radiation is often the predominant feature of the secondary radiation at short distances from the metal. With 1,000-kv. x-rays, a 6-foot air distance is sufficient to absorb the electron radiation, while for 2,000-kv. or radium gamma rays, a 12-foot air distance should be allowed.

In the radiography of metals, therefore, heavily filtered primary radiation (Table I, column 4) should be used to expose calibration films with voltages up to 1,000 kv. Above this, the filtration is unnecessary. In exposing the heavier metals, such as iron, brass, or lead, in an open installation, adequate air space between specimen and personnel must be allowed for the absorption of soft secondary radiations.

THE LEAD-CROSS PACKET

Early in the atomic-energy project, a special film packet was designed to monitor personnel exposed to uranium. It was intended to permit separate evaluation of gamma and beta radiations. Type K Film was selected because of its high speed to gamma rays. It was enclosed in a dental-type packet without lead foil. A cross of lead, 0.5 mm. thick, was mounted over the face of the packet, with the ends of the cross overlapping the back of the packet for a distance of about 1/4 inch.[3] This thickness of lead, with the thin brass of the enclosing badge, was sufficient to absorb the beta radiation while transmitting the gamma radiation.

The open corners of the packet recorded both the beta radiation and the gamma radiation. The gamma radiation was evaluated under the ends of the lead cross where the lead covered the film on both sides. The intensifying factor of the lead for the gamma rays is 1.3, and, by dividing this into the observed gamma-ray exposure, the effect of gamma radiation upon the corners of the film could be determined. Subtraction of this from the total photographic exposure in the corners gave the effect due to beta rays. This, however, introduced large errors into the estimated exposures when there was present an *unknown* mixture of hard and soft gamma radiation as well as beta rays. The conversion of film densities into exposures was accomplished with the aid of sensitometric exposures made either with x-rays or with gamma rays.

The principal beta radiation to which the Type K packets were exposed was that from UX_2 of 2.3 mev. The packets were calibrated by exposing them in contact with a sheet of metallic uranium. An exposure of about four hours was sufficient to produce a film density of 1.0. In a personal communication, K. Z. Morgan has called my attention to the following determinations of the beta-ray intensity in milliroentgens-equivalent-physical per hour, at the surface of uranium metal:

Not only is a filter thickness of 7 mg. per square centimeter necessary for the removal of alpha radiation, but it is considered to be the minimum thickness of the epidermal layer of the skin, and the amount of radiation reaching the basal

[3] The Type K Dental-Film packets, either with or without the lead cross, are available on special order, through a photographic dealer, from the Eastman Kodak Co., Rochester, N. Y.

Observer	Filter	Beta-Ray Intensity in mreps per Hour
T. E. Bortner (Oak Ridge National Lab.)	Polystyrene 6.94 mg. per sq. cm.	240
B. Kalmon (Oak Ridge National Lab.)	Aluminum 6.6 mg. per sq. cm.	244
H. Bass, H. DiGiovanni, and H. D. Levine (7)	7 mg. per sq. cm.	239

layer of the epidermis is of primary concern. For calibration purposes, it might be more consistent to use even more filtering. The paper fronts of most dental packets meet this condition.

FILM MARKERS

It is generally advisable to mount a metal marker over a monitoring film, that is, something that will cast a shadow to indicate that the density observed is due to penetrating radiation and not to some other cause. A strip of lead, 0.5 mm. thick or more, is usually satisfactory. With the higher-energy radiations (200 kv. or above), it is helpful to interpose 0.25 mm. of copper between the lead and the film to reduce the intensifying action and thereby obtain a deeper shadow. The American Standards Association (1) has suggested a marker in the form of a metallic echelon, built up of a bottom layer of aluminum, with successively smaller layers of copper and lead, each of 0.5 mm. thickness. With sufficient exposure of the film, such a marker will give a rough idea of the quality of the radiation.

The marker should be fastened securely to the film packet so that its position will not change. A badge for carrying the film usually includes openings or other features that will serve as a marker.

SUMMARY

Films used for monitoring stray radiation should be processed together with similar films, called "calibration" films, exposed to known quantities of radiation expressed in roentgens. The exposures on the monitoring films are then estimated by comparing their densities with those of the calibration films. Since the film response, in terms of roentgens, varies greatly over certain ranges of radiation quality, the calibrating radiation should, ideally, be of the same quality as the recorded stray radiation. In general, this is not practical. Instead, a suitable quality of primary radiation must be chosen, one which will enable the monitoring films to evaluate correctly, or at least not seriously undervalue, the incident stray radiation. The principal phases of this study have involved the comparison of the qualities of primary and attendant stray radiations, and of their relative photographic and ionization effects, in order to select suitable calibrating radiations for various practical situations.

Pardue, Goldstein, and Wollan have proposed that cadmium filters be mounted over the film to equalize its effective sensitivity over a wider range of radiation energies. The present experiments indicate the most favorable conditions for the use of this procedure for monitoring purposes.

The application of the lead-cross packet in monitoring both the gamma and beta radiations from uranium is described briefly.

NOTE: It is a pleasure to acknowledge the able assistance of Mr. Adrian H. Dahl, Mr. George M. Corney, Mr. William Crowe, Mr. Wayne Larimore, and Mr. Douglas Strangways in various phases of this investigation. I am also very grateful to Dr. K. Z. Morgan, of the Oak Ridge National Laboratories, for a number of constructive suggestions which have been incorporated in this paper, and to my associate, Dr. H. E. Seemann, for his help in the final revision of the manuscript.

Eastman Kodak Co.
Kodak Park Works
Rochester, N. Y.

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SUMARIO

El Empleo de Películas Fotográficas para Distinguir Rayos X y Gamma Errantes

Las películas empleadas para despistar rayos errantes deben ser preparadas, junto con películas semejantes, llamadas películas de "calibración," expuestas a cantidades conocidas de irradiación, expresadas en roentgens. Luego se calculan las exposiciones en las películas de despistaje, comparando las densidades de las mismas con las películas de calibración. Como la respuesta de las películas, en términos de roentgens, varía considerablemente en ciertas escalas de irradiacíon, lo ideal sería que la irradiación de calibración poseyera la misma calidad que la errante registrada. En general, esto no resulta factible. En vez de ello, hay que escoger una clase apropiada de irradiación primaria, que capacite a las películas de despistaje para valuar debidamente, o a lo menos, para no depreciar mayor cosa, la radiación errante incidente. Las principales fases del estudio actual han comprendido la comparación de las clases de rayos errantes primarios y acompañantes, y de sus relativos efectos fotográficos y yonizantes, a fin de seleccionar adecuadas radiaciones de calibración para varias situaciones prácticas.

Pardue, Goldstein, y Wollan (6) han propuesto que se monten filtros de cadmio sobre la película para igualar la sensibilidad efectiva de la misma en una escala mayor de energías radiantes. Esto da por resultado forzosamente una notable variación en la respuesta de la película, correspondiendo al ángulo de la radiación incidente. Por esa razón, propónese el empleo de un filtro de cadmio más delgado que el que se escogería para irradiación perpendicular. En esa forma se evitarán depreciaciones, aunque se sobrepreciarán las radiaciones más próximas a la perpendicular. Esa sobrepreciación, sin embargo, milita en pro de la seguridad.

Descríbese sucintamente la aplicación del paquete de plomo cruzado en el despistaje de los rayos tanto gamma como beta del uranio.

A Roll-Film Apparatus for Rapid Serial Filming[1]

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FOR MANY YEARS the problem of recording radiographically the changing appearance of certain internal organs has intrigued and challenged radiologists. Groedel (1) in Germany and Cole (2) in America were among the first to accomplish rapid serial filming. The great interest in angiocardiography in the last decade, particularly since some demonstrable lesions are now amenable to surgery, has intensified the search for an ideal method of rapid serial filming. As regards angiocardiography, the recent article by Fredzell, Lind, Ohlson, and Wegelius (3) states well the stringent demands placed upon filming devices if the cardiac dynamics are to be ideally recorded. These demands include direct roentgenography on normal-sized film at twelve exposures per second, exposure time not exceeding 0.02 seconds, synchronous exposures at right angles, and a record of the exposure interval in relation to a simultaneous electrocardiogram. Essentially the same, though somewhat less stringent, ideals have been stated by others (4, 5). The ingenious device described by Fredzell which satisfies these demands is probably the most advanced apparatus reported to date.

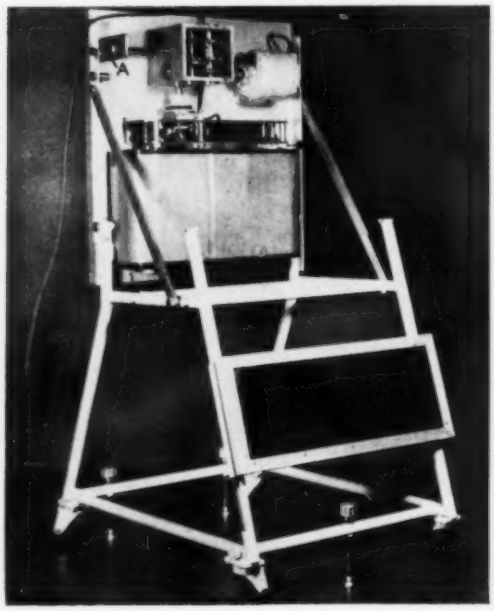

Fig. 1. Roll-film apparatus for rapid serial filming, viewed from behind. A. Exposure speed-selector knobs.

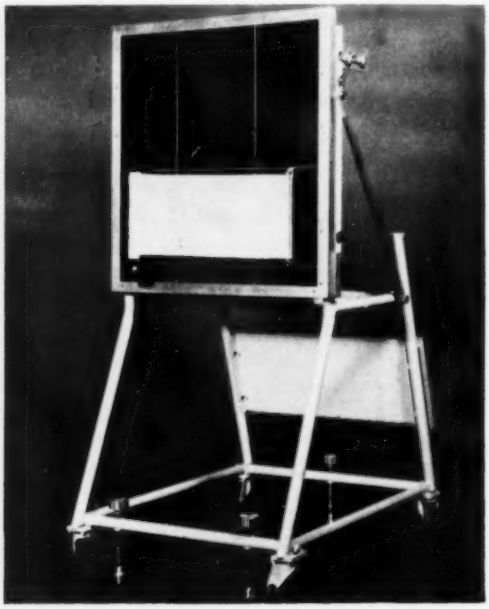

Fig. 2. Apparatus ready for vertical filming, viewed from the front.

Unfortunately such refined equipment is not available in every laboratory performing angiocardiography. The extreme cost of a fixed installation with high-energy generators for the performance of infrequent examinations is an obvious limitation. However, at the sacrifice of very

[1] From the Department of Roentgenology, University of Michigan, Ann Arbor, Mich. Accepted for publication in June 1950.

high speed of filming and simultaneous two-plane projection, useful morphologic and dynamic information can be obtained with simpler apparatus. Nevertheless, this simpler equipment must provide automatically timed short exposures at rates of two to six films per second if the examination is to be more than occasionally satisfactory (4). These requirements apply particularly to the study of congenital heart disease. Slower rates of filming are satisfactory and sometimes even desirable in other serial examination technics. Serial exposure apparatus must be of moderate cost and preferably of mobile type if it is to find wide application in practice.

Today the trend in rapid serial filming devices appears to be away from instruments which shift multiple cassettes and those which make use of the photofluorographic principle, toward those using roll film of generous width (6, 7). The last mentioned provide highly desirable direct filming on large-size film at adequate filming speeds with only moderate investment. Previously we have described such a device (4), and in this paper we present an improved model. Like the former, this newer apparatus was constructed in the X-Ray Laboratory of the University of Michigan. Incentive to its construction was the desire for filming speeds of four and six per second for congenital heart disease, which makes up the major application of angiocardiography in this hospital. Also, somewhat larger film size was desired for adult studies. This new apparatus features direct radiography on 11-inch-wide film moved intermittently between high-speed intensifying screens, exposure speeds of 1.3, 2, 4, and 6 films per second, removable film magazine, horizontal or vertical filming, mobility, simple and dependable automatic operation.

The apparatus consists of a mechanism to provide intermittent film advancement and screen motion and a removable film magazine driven by a gear reduction and shifting device. These are mounted on the back surface of a tilting table (Fig. 1) 29 inches wide and 32 inches long.

The tilting table is mounted on a pipe frame base in such a way that it can be used in either the vertical (Fig. 2) or the horizontal position (Fig. 3). The base is designed to provide free leg room for filming in the postero-anterior or anterior-oblique positions (Fig. 7). For horizontal filming, a removable headrest is readily attached (Fig. 3). Without this headrest in position, the distance between the edge of the table and the edge of the exposure frame (etched in white on the front panel) is two inches. This feature is of value in positioning patients for cerebral angiography. A removable compression band is provided to aid in maintaining the position of the patient during the procedure.

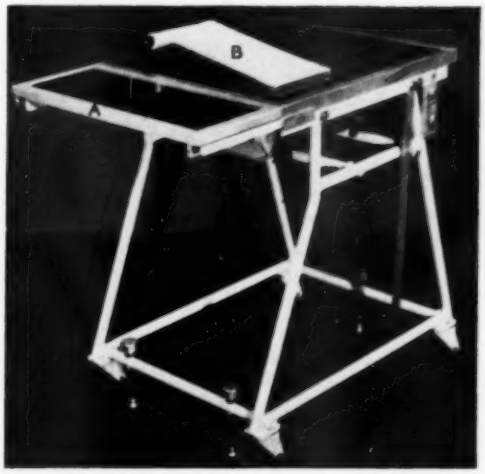

Fig. 3. Apparatus tilted into horizontal position. A. Removable headrest. B. Removable compression band.

Details of the driving mechanism are shown in Figure 4. The gear box reduces the motor speed by means of a worm gear and provides for selection speeds of 1.3, 2, 4, and 6 exposures per second. The constant-speed worm wheel shaft drives an intermediate shaft through either one of the two available gear ratios. This intermediate shaft in turn powers the drive shaft through one of a similar set of gear ratios. Two exposure speed-selection knobs (Fig. 1) operate interlocks (only one visible) to select the desired gear ratios. The selected speed is then transferred by the drive shaft, through a universal joint, to the driving

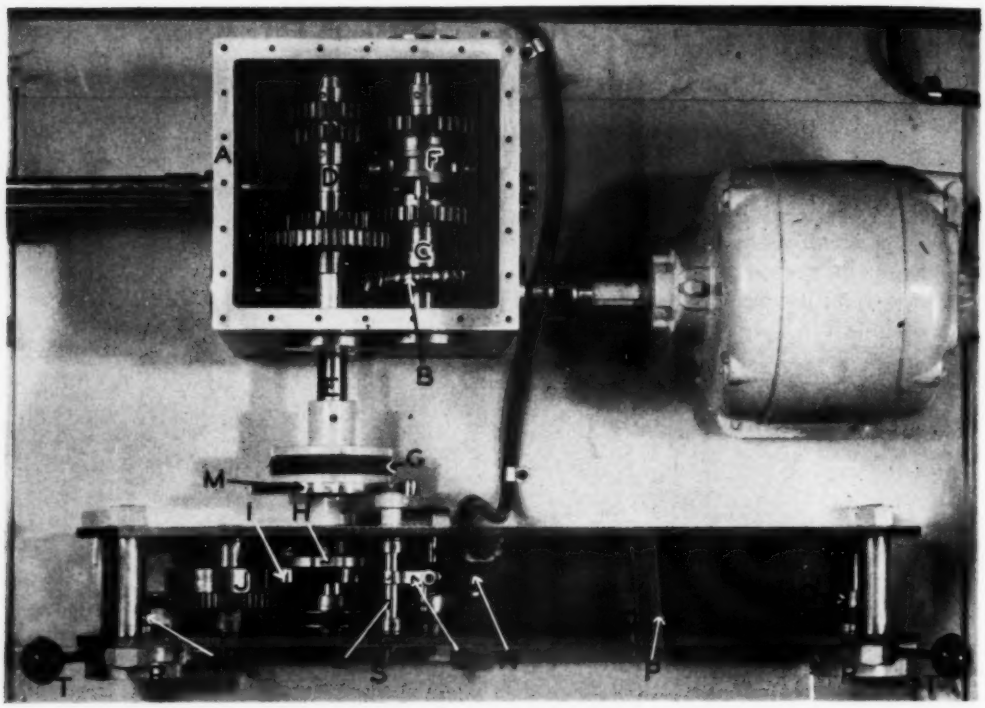

Fig. 4. A. Gear box. B. Worm gear. C. Worm wheel shaft. D. Intermediate shaft. E. Drive shaft. F. Interlocks. G. Universal joint. H. Driving member of Geneva gear. I. Cam follower bearings. J. Star wheel or driven member of Geneva gear. K. Take-up spool shaft. L. Screen cam shaft. M. Screen cam. N. Microswitch. O. Exposure lever arm. P. Supply spool belt drive. Q. Supply spool drive shaft. R. Bayonet-type lock. S. Screen cam shaft connector. T. Bayonet lock handles.

member of a Geneva-type gear. One of the two cam follower bearings (only one visible) mounted on this driving member intermittently rotates the star wheel or driven member of the Geneva gear through 90°. The 90° rotation of the driven member is converted to one full revolution of the take-up spool shaft by means of a 4:1 step-up gear ratio. The single revolution of the take-up spool advances the film for the succeeding exposure. This film-moving portion of the cycle occupies 50 per cent of the duration of one cycle. The remainder or exposure portion of the cycle is devoted to closing the screens, making the exposure, and then opening the screens preparatory to film advancement. The maximum exposure time at different speeds is as follows: 1/5 second at 1.3 per second, 1/8 second at 2 per second, and 1/30 second at 4 per second. During this exposure portion of the cycle, motion of the driven member (and hence film motion) is prevented by interlocking surfaces of the Geneva gear. A screen cam shaft operating from a screen cam on the drive shaft is designed to close the intensifying screens at the end of the film-moving portion of the cycle and to open them just prior to the beginning of film movement. A slight amount of over-travel on the screen cam shaft closes a microswitch through an exposure lever arm. The microswitch initiates the exposure through an electronic timer and is permanently adjusted to originate the x-ray exposure as soon as the screens are completely closed. A belt drive from the drive shaft rotates the supply spool shaft continuously providing several loose turns of film on the supply spool, thereby decreasing the intermittent load on the mechanism and preventing

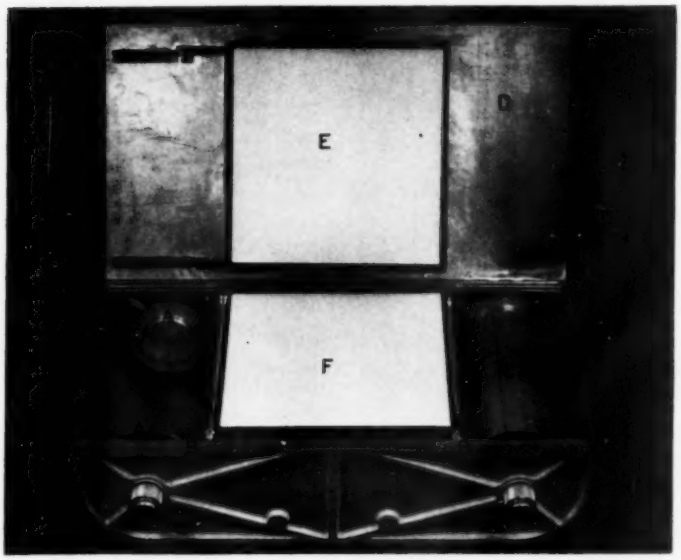

Fig. 5. A. Supply-spool flanges. B. Film-guide rollers. C. Take-up spool. D. Light-proof hinged cover. E. Front intensifying screen. F. Back intensifying screen.

Fig. 6. A. Bayonet locks and supply spool drive shaft connector. B. Bayonet lock and take-up spool drive shaft connector. C. Screen cam shaft connector. D. Platen for back screen. E. Screen cam shaft lever mechanism. F. Magazine cover lock.

damage to the film. Attachment of the magazine is accomplished by bayonet-type locks which hold the magazine firmly and accurately against the driving mechanism, automatically centering the take-up and supply spool drive shafts to their counterparts in the magazine (Fig. 6). A simple screwdriver-type connector on the screen

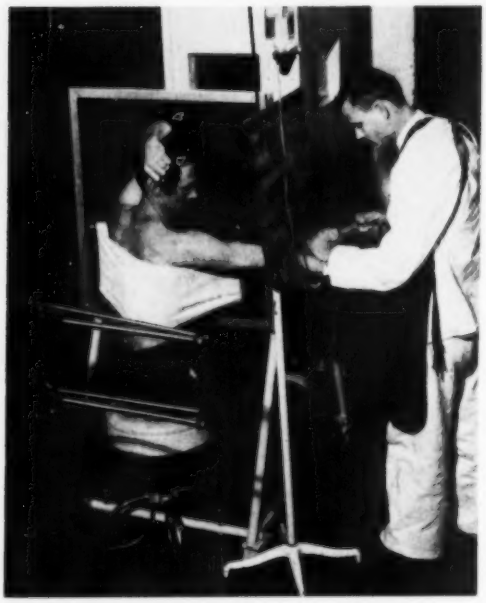

Fig. 7. Patient in position for filming in left anterior oblique projection.

cam shaft engages automatically with its counterpart on the magazine in the same operation.

The magazine is shown in position for loading in Figure 5. Roll film, 11 inches wide and of any desired length up to 75 feet, is obtained on cardboard spools and is readily inserted between supply-spool flanges. The film is drawn over the two film-guide rollers and the end inserted in the take-up spool slot. The light-proof cover is then locked and the magazine is ready for filming. The exposure opening in the front cover of the magazine is covered with a thin sheet of opaque plastic on which is mounted the front intensifying screen. The back intensifying screen is mounted on a platen to which in-and-out motion is imparted from the screen cam shaft by means of the lever mechanism shown in Figure 6. The entire magazine, except for the screen cam shaft mechanism and bayonet locks, is machined from magnesium alloy castings and plate and weighs only 29 pounds when loaded with film. Lead protection for the take-up and supply rolls of film is provided on the back of the table top. A removable cross-hatched wafer grid is also attached to the back of the table top.

While the apparatus is designed to operate at a maximum speed of six films per second, in actual use four films per second has been the maximum obtained. The great stress of acceleration and deceleration of the take-up spool at six films per second has so far prevented use at this speed.

This apparatus has been in clinical use in the University Hospital since December 1949 in the performance of over sixty examinations. Apparatus failure has not occurred to mar any one of these. As indicated above, the desirable features of the apparatus include removable film magazine, ample-sized film, exposure rates up to four per second, and simplicity and dependability of operation. The effort and expense of the design and construction of such an apparatus have been amply rewarded by films of greater diagnostic value. It is clearly realized that the apparatus does not satisfy all the demands for ideal angiocardiographic recording, but it has proved a practical and satisfactory, though partial, solution to the problem of rapid serial filming.

SUMMARY

An improved model of a rapid filming device previously described is presented. It features direct radiography on 11-inch-wide film moved intermittently between high-speed intensifying screens, exposure speeds of 1.3, 2, and 4 films per second, a removable film magazine, horizontal or vertical filming, mobility, and simple and dependable operation.

ACKNOWLEDGMENT: The authors wish to express their gratitude to Mr. J. A. Van den Broek II and Mr. Quentin Westrick for their cooperation in the design and construction of the apparatus.

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SUMARIO

Aparato con Rollos de Película para Rápida Radiografía Seriada

El modelo presentado constituye un perfeccionamiento del aparato para radiografía rápida previamente descrito (Radiology **53:** 729, 1949). Sus características comprenden: radiografía directa en película de 27.5 cm. del ancho, movida intermitentemente entre pantallas intensificadoras de alta velocidad, velocidades de exposición de 1.3, 2, y 4 radiografías por segundo, cámara desmontable para películas, radiografías horizontales o verticales, movilidad y funcionamiento automático sencillo y seguro.

El aparato consta de un mecanismo que hace avanzar la película y mover la pantalla intermitentemente y una cámara desmontable para películas, impulsada por un accesorio de reducción y cambio de engranaje. Estos van montados en la cara posterior de una mesa de báscula, la cual a su vez está montada de modo que pueda usarse ya vertical u horizontalmente.

Irradiation of Bone Lesions in the Presence of Metallic Intramedullary Fixation[1]

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THE TREATMENT of pathologic fractures of the long bones, especially the femur, has been greatly forwarded by the use of the intramedullary nailing method of Küntscher (1940). The operation is simple, fixation is maintained without supplementary apparatus, immediate activity is usually possible, and there is a tremendous decrease in morbidity. Experience abroad has been confirmed in this country. A recent editorial by Cave (1949) acknowledges the great value of intramedullary fixation in stabilizing painful pathologic fractures of the femur.

Pathologic fractures of the long bones resulting from both primary and secondary bone tumors have been treated satisfactorily by intramedullary nailing (Table I).

TABLE I: BONE TUMORS CAUSING FRACTURES TREATED WITH INTRAMEDULLARY NAILING

Primary Bone Tumors
Osteitis cystica localisata: Böhler (1944); Griessmann and Schüttemeyer (1947)
Giant-cell sarcoma: Westerborn (1948).
Enchondroma: Nydahl (1950)
Secondary Bone Tumors (Metastatic Bone Disease)
Epithelioma: Soeur (1946)
Carcinoma of the alveolar ridge: Ehrenhaft and Tidrick (1949)
Carcinoma of the breast: Griessmann and Schüttemeyer (1947); Moeys (1948); Ehrenhaft and Tidrick (1949)
Carcinoma of the thyroid: Ehalt (1949)
Carcinoma of the renal cortex: Haase (1943); Ehrenhaft and Tidrick (1949)
Multiple myeloma: Soeur (1946); Ehrenhaft and Tidrick (1949).

It has been suggested that in the presence of bone lesions where spontaneous fracture appears to be imminent, intramedullary nailing be carried out as a prophylactic measure (Griessmann and Schüttemeyer, 1947). The majority of patients treated in this manner have received no further therapy. Occasionally irradiation has been given in order to control local tumor growth and promote recalcification and healing. It is the purpose of this paper to discuss the effect of the presence of a large metallic intramedullary nail upon the application of radiation therapy to primary or secondary bone lesions.

Fig. 1. Photograph showing the model, the cone, the dosimeter, and the measuring device.

METHODS

A femur was obtained from a freshly embalmed cadaver. This was incorporated into a wax model so constructed that it closely conformed in configuration and density to the normal soft tissues about the upper end of the femur. A roentgenogram of the completed model showed it to have a

[1] From the Department of Surgery (Dr. Peltier) and the Department of Radiology (Dr. Nice), University of Minnesota Medical School, Minneapolis 14, Minn. Accepted for publication in May 1950.

uniform consistency, without cracks or air bubbles. With the use of this model, a series of measurements was made before and after the insertion of a "cloverleaf" intramedullary nail (1 × 44 cm.) made from S.M.O.[2] (Zimmer and Company). The nail was placed in the medullary cavity just as in the treatment of fractures.

The model was irradiated through an anterior port 10 cm. square with a General Electric Maximar machine, at 220 kv., 15 ma., with 1.0 mm. copper and 1.0 mm. aluminum filtration, half-value layer 1.7 mm. copper, and a target-object distance of 60 cm. The field was defined with one layer of leaded rubber shields, and later with two layers. No difference was observed. Radiation was measured by means of a Victoreen thimble dosimeter (Fig. 1). All measurements were corrected for temperature and barometric pressure, and have been reduced to roentgens per minute for convenience of presentation. Readings were taken at four points, three areas on the posterior surface of the model and one immediately beneath the posterior cortex of the shaft of the femur (Fig. 2). Roentgenograms were made to demonstrate that the ionization chamber of the dosimeter, in the latter position, was completely shielded by the nail when it was in place. Measurements were made in a random fashion in these four areas and repeated in each area at least five times. Two groups of measurements were made, one before and one after the insertion of the nail. Measurements in both groups were made on several different days.

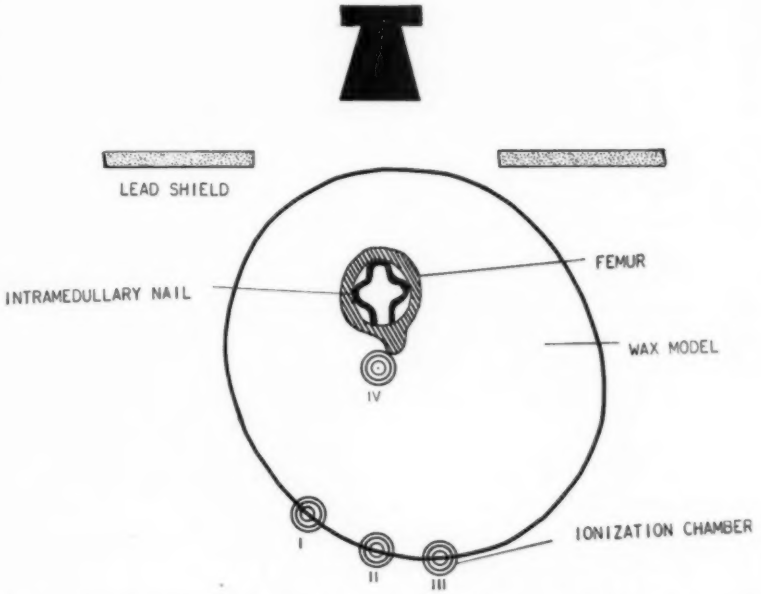

Fig. 2. Diagram showing the position of the ionization chamber in relation to the source of radiation, the bone, and the model.

RESULTS

The results of the measurements are presented in Table II.

Measurements in areas I and III in the periphery of the port, away from the bone, appear to be unaffected by the presence of the nail. Areas II and IV, shielded by the nail, show a decrease in the measured

[2] 18-8 S Mo stainless steel, an alloy containing 18 per cent chrome, 8 per cent nickel, and 2 3/8 per cent molybdenum.

TABLE II: AMOUNT OF RADIATION (ROENTGENS/-MINUTE) DELIVERED TO THE MEASURED AREAS OF THE MODEL (SEE FIG. 2)

	Before Insertion of the Nail			
	I	II	III	IV
	3.65	4.11	4.40	14.50
	3.68	4.15	3.94	14.60
	3.70	4.04	4.11	13.90
	4.07	4.57	4.75	15.67
	4.00	4.35	4.75	14.75
Av:	3.82	4.30	4.39	14.68
	After Insertion of the Nail			
	I	II	III	IV
	3.42	3.37	3.96	10.32
	3.60	3.40	3.83	10.85
	3.52	3.32	4.01	11.05
	4.30	3.50	4.50	10.60
	4.00	3.50	4.60	10.60
	4.00	3.30	4.50	10.60
Av:	3.81	3.39	4.23	10.67

amount of radiation of 22 per cent and 28 per cent respectively.

DISCUSSION

Upon undertaking this experiment, we expected to find a decrease in the amount of ionization in the area shielded by the nail but, since secondary irradiation would occur in this area, the actual difference could not be predicted. For this reason, the actual measurements were made. It is noteworthy that after the insertion of the nail there is a reduction of the ionization in the area of the bony cortex shielded by the nail of about 30 per cent. The practical implication of this fact is that tumor cells in the area of a pathologic fracture shielded by the nail receive only about 70 per cent of the calculated delivered dose of radiation. To compensate for this loss, a larger dose must be given, and/or multiple ports must be used to deliver radiation to the bone lesion.

CONCLUSIONS

With the use of a model of the upper third of the thigh, measurements of the delivered dose of irradiation have been made before and after the insertion of an intramedullary nail. These measurements demonstrate a loss of about 30 per cent of the measured delivered dose in the area shielded by the nail. Therefore, in order to deliver a satisfactory amount of radiation to the tumor cells in the shielded area, larger doses and/or multiple ports should be used.

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SUMARIO

La Irradiación de Lesiones Oseas en Presencia de Fijación Intramedular Metálica

Debido a la costumbre de usar clavos para la fijación intramedular en las fracturas patológicas producidas por tumores óseos, los AA. trataron de determinar el efecto del clavo de metal sobre la aplicación de la radioterapia al tumor. Las mediciones realizadas en un modelo del tercio superior del muslo, antes y después de la introducción de un clavo intramedular, revelaron una pérdida aproximada de 30 por ciento de la dosis medida entregada, en la zona cubierta por el clavo. A la luz de lo anterior, a fin de entregar una cantidad satisfactoria de rayos a las células neoplásicas en la zona cubierta, hay que usar dosis mayores y/o muchas puertas.

A Case of Ileo-Ileal Intussusception of Unusual Etiology[1]

HARRISON H. RICHARDSON, M.D.[2]

Most of the available literature on intussusception deals with this condition as it occurs in infants and young children. Indeed, it constitutes one of the more common intra-abdominal emergencies encountered in pediatrics. The entity may also be observed in adults. Iason (1) states that about 5 per cent of all intussusceptions occur in adults, and McIver (2) found approximately the same incidence in his series of 335 cases. While intussusception in adults forms only a small proportion of the cases reported, it is by no means a medical curiosity, though its recognition is not always easy.

Lewis and others (3–6) emphasize that organic lesions should always be considered when dealing with intussusception in the adult. Intestinal tumor, Meckel's diverticulum, and hypertrophied lymphoid tissue have been reported as etiologic agents. It has been stated that 50 per cent of adult cases of intussusception may be accounted for by diverticula of the Meckel type (3). These may contain the normal elements of intestinal mucosa, but gastric, duodenal, or aberrant pancreatic tissue has been found in 15 to 20 per cent of the cases. Carcinoma of Meckel's diverticulum is rare, but adenocarcinoma, medullary carcinoma, and fibrosarcoma have all been observed (7).

Certainly, tumor is the etiologic factor in a large percentage of adult cases, as is apparent from the classical reviews by Eliot, Christopher, Nichols and others (5, 6, 8, 9). In two-thirds of the cases of tumors of the small bowel causing obstruction, as reported by Rankin and Newell (10), the symptoms were caused by intussusception.

Intussusception has also been reported complicating granulomatous, parasitic, and inflammatory conditions such as tuberculosis, amebiasis, round worm infestation, and typhoid fever (11–14). Appendiceal lesions, foreign bodies, trauma, postoperative adhesions, and aberrant islets of tissue account for a small percentage of cases (15–19). Other less important provocative influences which may be mentioned are dysentery and congenital ileal bands. Even a sudden radical dietary change has been described as a factor.

There is a paucity of information concerning masses of aberrant tissue initiating intussusception, but one comparatively recent case due to aberrant pancreatic tissue has been reported (20).

Spontaneous invagination in the adult is not considered rare by some authors, but certainly the number of idiopathic cases in adults does not approach that in infants and young children (21).

The case to be presented here was thoroughly studied preoperatively at two hospitals and although, in retrospect, the patient clinically and roentgenologically presented some characteristic signs of intussusception, the diagnosis was not made prior to operation.

A 29-year-old white male was admitted to the hospital complaining of intermittent epigastric pain for two months, worse on arising in the morning and occasionally occurring at night. It was usually colicky in nature but was relieved by alkalies or food. There had been no nausea or vomiting, hematemesis, or tarry stools. For five days before admission the patient had had almost constant pain, partially relieved by a prescribed medication taken in milk. Roentgenograms taken the day before admission were reported as having shown "acute gastric ulcer."

[1] From Radiological Service, Veterans Administration Hospital, Aspinwall, Penna., and the University of Pittsburgh School of Medicine. Reviewed in the Veterans Administration and published with the approval of the Chief Medical Director. The statements and conclusions published by the author are the result of his own study and do not necessarily reflect the opinion or policy of the Veterans Administration. Accepted for publication in June 1950.

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The past history included "ptomaine poisoning" two years previously and one attack of burning epigastric pain lasting a few days one year prior to admission. The family history was negative. The patient had recently lost his job in a steel mill during a lay-off period and was much worried over the support of his wife and three children.

On physical examination the patient appeared fairly well developed and nourished, slightly pale, quite tense, and in considerable pain. The temperature, pulse, and respirations were normal. There were vague tenderness and moderate involuntary spasm in the upper abdomen, with normal peristaltic sounds. Examination was otherwise entirely negative.

Laboratory findings showed a normal blood count. Urinalysis and serologic tests were negative. The sedimentation rate was 4 mm. per hour. The total gastric acid content was 42 units; free acid 17 units. The serum amylase was 55 glucose equivalents. Stool examination was positive for cysts of *E. histolytica*. Fluoroscopic and roentgenographic studies of chest, stomach, small bowel, colon, and gallbladder were all reported normal.

Treatment included a Sippy diet, later modified with high protein intake. Amphojel, analgesics, sedatives, tincture of belladonna, and atropine were administered empirically. Carbarsone and diodoquin were given following the evidence of parasitic ova in the stools.

During the hospital course there was frequent recurrent epigastric pain, with associated nausea and vomiting. The pain was largely crampy in type and irregular in occurrence, with occasional almost symptom-free intervals of one or two days. On one occasion there was radiation of the pain to the back. Codeine and demerol were frequently required for pain relief, but vomiting was protracted enough to require parenteral fluids on only one occasion. There was a gradual weight loss of 14 pounds.

The patient seemed tense, anxious, and emotionally unstable. He was examined by a neuropsychiatrist, who felt that there was psychogenic gastro-intestinal disturbance manifested by abdominal pain, and that the presence or absence of an ulcer was of secondary importance. The patient was transferred to the neuropsychiatric service and appropriate therapy was begun. He exhibited many immature reactions, but during psychotherapy there was a gradual decrease in his symptoms. Three stool examinations following the course of carbarsone and diodoquin were negative for ova and parasites. He was discharged with the diagnosis of amebiasis and psychogenic gastro-intestinal disturbance manifested by abdominal pain.

Three weeks later the patient was admitted to another hospital, complaining of recurring crampy abdominal pain with occasional vomiting. After admission, the vomitus was noted to be blood-

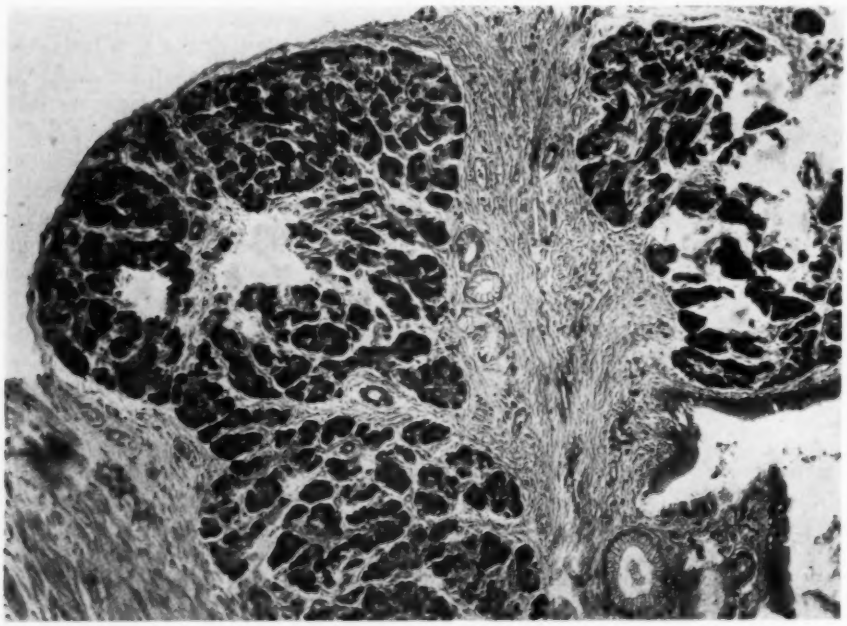

Fig. 1. Section from wall of ileum showing two pancreatic lobules with several typical ducts.

Fig. 2. The barium-filled colon. Arrows denote parallel convex lines running transversely to the intestinal axis of the ileum. These outline the contours of the mucosal folds within the invaginated sheath.

Fig. 3. Roentgenogram obtained following evacuation. The arrows point to the invaginated mass which demonstrates the "concentric ring" appearance in this end-on projection.

flecked. Four stool examinations were positive for occult blood and showed occasional Ascaris ova. An upper gastro-intestinal study was reported as showing an irregular filling defect along the greater curvature of the stomach, suggestive of an infiltrating neoplasm. Studies of the duodenum and small bowel and a barium enema examination of the colon were reported as normal.

Surgical exploration was done on the seventh hospital day. The stomach was normal. There was an intussusception of the ileum approximately 20 cm. from the ileocecal junction. The intussusception involved about 20 cm. of the bowel. There was no evidence of a Meckel's diverticulum. The segment was removed and an end-to-end anastomosis was done. At one end of the specimen was an elevated mass, 4.5 × 4.0 × 2.0 cm., beneath the mucosa. The surface of the latter was dull yellow and was thrown into ulcerated cauliflower folds which proved on section to be polypoid. Microscopically there were nests of pancreatic acini with small ducts but no islet tissue lying in the submucosa and muscularis. The overlying mucosa showed alternate areas of hyperplasia and ulceration (Fig. 1). The diagnosis was aberrant pancreatic tissue in the ileum, with intussusception.

DISCUSSION

Intussusception in the adult presents a variable symptomatic picture, but some degree of obstruction, either acute, chronic, or recurrent, is usually present. The cardinal symptoms have been described as: periodic attacks of epigastric pain, intermittent vomiting, passage of blood and mucus per rectum, and the presence of a palpable mass (3). Of these, pain and vomiting are practically constant in occurrence. The attacks may be intermittent, but painful sudden seizures are considered characteristic. Melena is associated less constantly with intussusception in the adult than in the infant, and the bleeding usually originates from ulceration of a tumor rather than from the resultant intussusception. The presence of a palpable tumor similarly is less constant among adults; an incidence of 60 to 80 per cent of cases would probably represent a high estimate (19). Associated distention and the difficulties often experienced in palpation of the adult abdomen may account in part for this.

When the intussusception produces large bowel obstruction, retrograde filling is almost always encountered during the administration of the barium enema. Usually the barium enema is of no value in enteric intussusceptions but occasionally, as in the case reported here, enough reflux into the terminal portion of the ileum may be obtained to permit visualization of the intussuscepted mass. In such cases the "concentric ring" appearance is a prominent feature. Characteristically, it is manifested in the roentgenogram by a narrow line of barium in the center of a filling defect. If the barium has entered the sheath, the contours of mucosal folds can be seen running transversely to the long axis of the intestine.

Figure 2 shows a portion of the barium-filled colon, with a convex line running horizontally above the sigmoid. This obviously represents the invagination of the ileum and, on close inspection, lines may be defined running transversely to the long axis of the intestine.

In Figure 3, made after evacuation, there appear to have been some rotation and shift of the invaginated portion of the bowel. In this apparently axial projection of the invaginated sheath of bowel, several more or less concentric circles over an area approximately 3 cm. in diameter may be defined. In retrospect, the appearance of the bowel in these views might have suggested to the observer the possibility of intussusception. The diagnosis, however, was missed on the initial roentgen study. During the second examination, at another hospital, the diagnosis of gastric neoplasm was made following a gastrointestinal series. The latter finding was the basis for the laparotomy, at which time the true etiologic factor was revealed.

The intussusception was not due to a Meckel's diverticulum, which might have been suspected from some of the initial roentgenograms, but was caused by a mass of aberrant pancreatic tissue lying beneath the intestinal mucosa. Aberrant pancreatic tissue may occur anywhere from the stomach to the terminal ileum, approximately 50 per cent of such deposits occurring above the ligament of Treitz.

Ulceration, hemorrhage, perforation, and obstruction are the usual complications and they may occur at any age.

CONCLUSIONS

Various etiological factors of intussusception in the adult have been listed and briefly discussed. A case of ileo-ileal intussusception due to aberrant pancreatic tissue within the ileum has been described.

A diagnosis of intussusception should be entertained in all adults presenting clinical evidence of intermittent obstruction of the bowel. Studies of both large and small bowel are recommended when clinically feasible. Particular attention should be directed toward collections of barium, the configuration of which may suggest invaginated portions of intestine, since the roentgen appearance may be characteristic and perhaps diagnostic.

ACKNOWLEDGMENTS: I am indebted to G. H. Alexander, M.D., Chief Radiologist, Veterans Administration Hospital, Aspinwall, for assistance in the preparation of this paper, and to R. C. Grauer, M.D., Pathologist, New Kensington Hospital, New Kensington, Pa., for the photomicrograph.

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SUMARIO

Caso de Invaginación Ileo-Ileal de Etiología Inusitada

Enuméranse aquí y discútense sucintamente varios factores etiológicos de la invaginación en el adulto. Descríbese además un caso de intususcepción íleo-ileal debida a una masa aberrante de tejido pancreático dentro del ileon.

Hay que considerar el diagnóstico de invaginación en toda persona adulta que presente signos clínicos de oclusión intermitente del intestino. Recomiéndanse estudios de los intestinos tanto delgado cuanto grueso siempre que sean clínicamente factibles. Hay que dedicar cuidadosa atención a las acumulaciones de bario, cuya configuración puede indicar la existencia de porciones invaginadas del intestino.

Hemangioma of Bone[1]

S. F. OOSTHUIZEN, M.D., D.Sc., F.R.C.P. Ed., D.M.R., F.A.C.R., and JAMES BARNETSON, M.D., D.T.M. & H.
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HEMANGIOMAS are congenital abnormalities rather than true tumors and most of them are present before birth. Hemangioma of bone is comparatively rare and usually affects the vertebrae, skull, and long bones. It may occur at any age and is equally distributed between the sexes. The common histologic types are: (*a*) capillary hemangioma, consisting of small vessels and capillaries separated by connective-tissue stroma, and (*b*) cavernous hemangioma, consisting of large thin-walled vessels and sinuses lined by endothelium and containing blood, with a delicate connective-tissue stroma. Angiosarcomatous tissue has also been found in bone.

Thomas (1942), in an excellent article on vascular tumors of bone, stated that they are mesenchymal in origin probably growing from embryonal remnants by a process of endothelial proliferation and differentiation into blood vessels. They are usually benign and may undergo regression and heal. True malignant angiomas also exist and are characterized by rapid growth, invasion of surrounding tissues, and distant metastases. In their histogenesis such tumors tend to revert to the original primitive mesenchymal tissue, producing a varied histologic picture and differing from the benign form.

Thomas described two main groups but with various intermediate forms between the extremes: (*a*) benign angioma of capillary or cavernous type, which is a slowly growing, well differentiated, congenital type of tumor with well formed blood vessels and showing a tendency to regress and heal; (*b*) malignant angioma, which shows much cellular activity, active endothelial proliferation, invasiveness, and a tendency to revert to its primitive mesenchymal structure.

CLINICAL FEATURES

The clinical findings in hemangioma of bone vary widely, depending upon the location of the tumor, the rapidity of growth, and the degree of malignancy. Frequently the lesion is entirely asymptomatic and is discovered only by accident. Where the site is in the vertebral column, neurological symptoms and signs may be present, usually as the result of enlargement or compression of the affected vertebral body, peridural extension, or pressure on the medulla and outgoing nerve roots.

RADIOLOGICAL FINDINGS

Vertebrae: The normal concavity of the vertebral body is usually replaced by convexity, and actual compression may be seen. As the result of irregular absorption involving some bone trabeculae and coarsening of the remaining ones, the well known appearance of vertical striation is produced. This appearance is not confined to the body itself but may also be seen in the transverse processes, a finding which helps in the differential diagnosis between hemangioma and localized Paget's disease of a vertebra.

Long Bones: The commonest type of appearance in the long bones is that produced by cystic changes, with well defined trabeculation. The radiographic picture may closely resemble that of giant-cell tumor and osteitis fibrosa cystica. The occurrence of punched-out areas distal to the lower border of the tumor is very suggestive of progression of the lesion.

Generally speaking, the radiographic appearances of hemangioma of long bones are not diagnostic.

Flat and Irregular Bones: Reduced translucency and coarse trabeculations, radiating from a common center usually at right angles to the plane of the bone, may

[1] From the University of Pretoria, Pretoria, South Africa. Accepted for publication in June 1950.

be seen in hemangioma of the flat or irregular bones. The appearances may not be diagnostic of the lesion.

TREATMENT

The diagnosis is usually made by biopsy, and treatment by radiotherapy and/or surgery should be instituted as soon as possible. There is always the danger of severe bleeding with surgery, and radiotherapy should be tried first except where immediate relief is sought, *e.g.*, with compression myelitis.

REPORT OF A CASE

The patient, a European male of 20, was referred for radiographic investigation of a tumor of the back the size of a cricket ball, which had been discovered accidentally a short while previously (Fig. 1). The history local and general physical examination failed to suggest the nature of the lesion.

Radiographic examination of the pelvis and lumbar spine showed evidence of markedly prominent and tortuous vascular channels on the left ilium, with evidence of increased size and density of the affected bone and pressure erosion of the left transverse process of L-5 (Fig. 2).

Fig. 1. Appearance of tumor on initial examination.

Fig. 2. Hemangioma involving the left ilium: initial roentgenogram.

Fig. 3. Roentgenogram made about two months after Fig. 2, showing progression of osseous changes.

Radiographic investigation of the entire skeleton and the chest failed to reveal any other abnormality. The findings on intravenous pyelography were normal, and the heart shadow was not enlarged or abnormal in shape.

The diagnosis suggested in the Radiological Department was *hemangioma involving the left ilium.*

Dr. R. M. Kark of Chicago, after consultation with Dr. M. P. Slaughter, offered valuable advice as to treatment after a study of the x-ray films.

Operation was performed by Dr. H. J. Besselaar, who approached the mass through a retroperitoneal

route immediately above the left os ilii in the lumbar region. The lumbar blood vessels, some of which were very dilated, were ligated and the external iliac and hypogastric arteries were temporarily clipped. The mass, which was of the nature of a "blood sponge," was seen to infiltrate the ilium. On account of severe bleeding, the operation had to be stopped, but the tumor was successfully removed at a subsequent operation, about two months later. It is as yet too early to determine whether the lesion has been satisfactorily eradicated.

In the interval between the operations, control radiography of the pelvis showed a distinct progression of the osseous changes (Fig. 3).

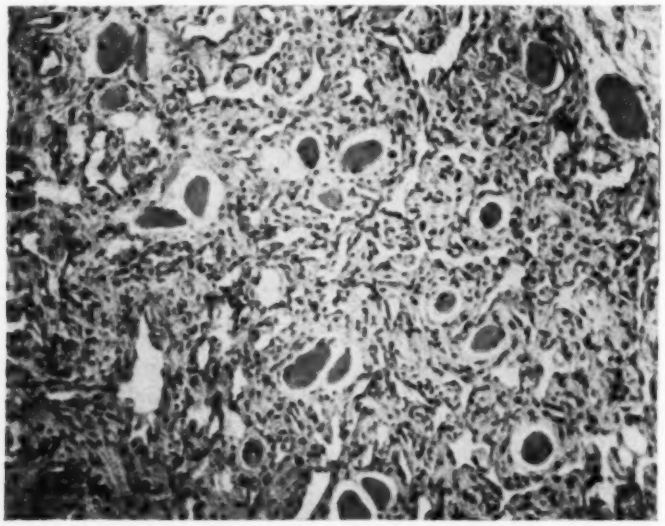

Fig. 4. Hemangioma of left ilium: bundles of striped muscle widely separated by angiomatous tissue. × 92.

The following *histologic report* was obtained: "Sections of the specimen, which extends outward from the ilium, show striped muscle widely infiltrated with angiomatous mesenchymal tissue. The muscle fibers are separated by this tissue and many have undergone atrophy. Numerous capillaries and small blood vessels are present in the mesenchymal tissues, and few mitotic figures can be seen.

"The findings are those of hemangioma. Taking into account the age of the patient as well as the histological features, the lesion is probably more of the nature of a hamartoma than a true neoplasm, but of a proliferative and infiltrating type" (Fig. 4).

COMMENT

The findings in this patient tend to support the views held by Thomas and other authorities. The outstanding feature in this instance, however, is the comparative ease with which the correct diagnosis could be made by radiographic examination of the affected part, without resorting to the use of a radiopaque medium. Tortuous, dilated vascular channels with increased density and dimensions of a flat bone must raise immediate suspicion of the existence of this type of lesion.

It is naturally not possible on the evidence before us to determine with certainty whether this is a case of primary hemangioma of the ilium or one of secondary osseous involvement from a hemangioma of muscle.

SUMMARY

The current views with regard to the pathology, clinical findings, and radiographic appearances of vascular tumors of bone are set forth.

A case is reported of hemangioma affecting the ilium of a young adult male, in which the diagnosis was made by radiographic investigation in the first instance and subsequently confirmed by operation and histologic examination.

ACKNOWLEDGMENTS: To Dr. H. J. Besselaar, for permission to publish this case; to Dr. R. M. Kark and to Dr. M. P. Slaughter, for advice regarding treatment.

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SUMARIO

Hemangioma de los Huesos

Expónense las ideas reinantes con respecto a la anatomía patológica, hallazgos clínicos y aspecto radiográfico de los tumores vasculares de los huesos.

Descríbese un caso de hemangioma que afectaba el ilion de un joven, en el cual se hizo el diagnóstico en primer lugar por investigación radiográfica y se confirmó después por la operación y el examen histológico.

Identification of Right and Left Sides in Roentgenograms by a Permanent Cassette Marker[1]

COLIN B. HOLMAN, M.D., AND JOHN D. CAMP, M. D.,
Section on Roentgenology, Mayo Clinic, Rochester, Minn.

UNIDENTIFIED or inaccurately labeled roentgenograms plague every radiologist at one time or another and make it necessary for him either to re-examine the patient or to rely on the memory of a technician in order to identify properly the right and left sides. Uncertain lateralizing identification can make the accurate comparison of a series of roentgenograms extremely difficult. This is especially true when films made by two or more radiologists are under consideration. The following suggestions are presented to help eliminate this source of confusion, although they are not intended as substitutions for the correct use of right and left identification markers by the technician.

The radiologist should always be able to place a roentgenogram for interpretation so that the side of the film toward him is the same as that toward the x-ray tube during the exposure. In other words, the radiologist should be able to see the part as the x-ray tube "saw" it. This renders it possible to visualize the patient's position in relation to the film when the exposure was made, and thereby to deduce the correct part and side of the patient, irrespective of the technician's marker. This proper orientation of the film can be most easily accomplished if a permanently mounted opaque marker is incorporated in the cassette so that its image will show on all films therein exposed. The marker must be asymmetrical in outline in order that its image will be recognized as perverted if the negative is held so that the side facing the radiologist is not that which was facing the tube during the exposure.

Such a marker consists of a small opaque capital letter "F" mounted on the rear surface of the bakelite front of the cassette in the manner indicated in Figure 1. The letter "F" is suggested because it is asymmetrical and therefore will appear perverted if the roentgenogram is not correctly oriented for interpretation. Furthermore, it might properly signify that the "front" of the film is presented to the observer just as it was to the x-ray tube during the exposure.

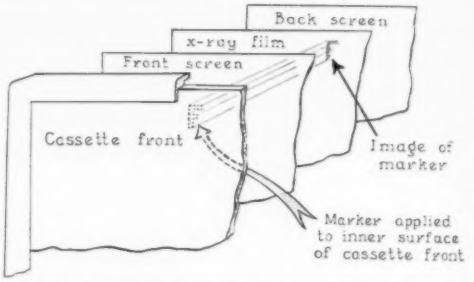

Fig. 1. Opaque marker, in the form of a letter "F", incorporated in the cassette.

Figure 2 shows a correctly marked postero-anterior projection of the head. With the film viewed so that the letter "F" can be read properly it is obvious that the patient's right side corresponds to the right side of the observer, for the patient was facing the cassette and the posterior portion of his head was toward the x-ray tube during the exposure. The radiologist can, of course, be sure that it is a postero-anterior exposure by the size and clarity of the orbital margins, facial bones, and teeth, which show little distortion and were obviously close to the cassette.

Figure 3 shows an anteroposterior roentgenogram of the head mislabeled as to its right and left sides. Since the patient must have been facing toward the x-ray tube during an anteroposterior exposure, his right side could not possibly correspond

[1] From an exhibit presented at the meeting of the Radiological Society of North America, Cleveland, Ohio, Dec. 4–9, 1949 Accepted for publication in June 1950.

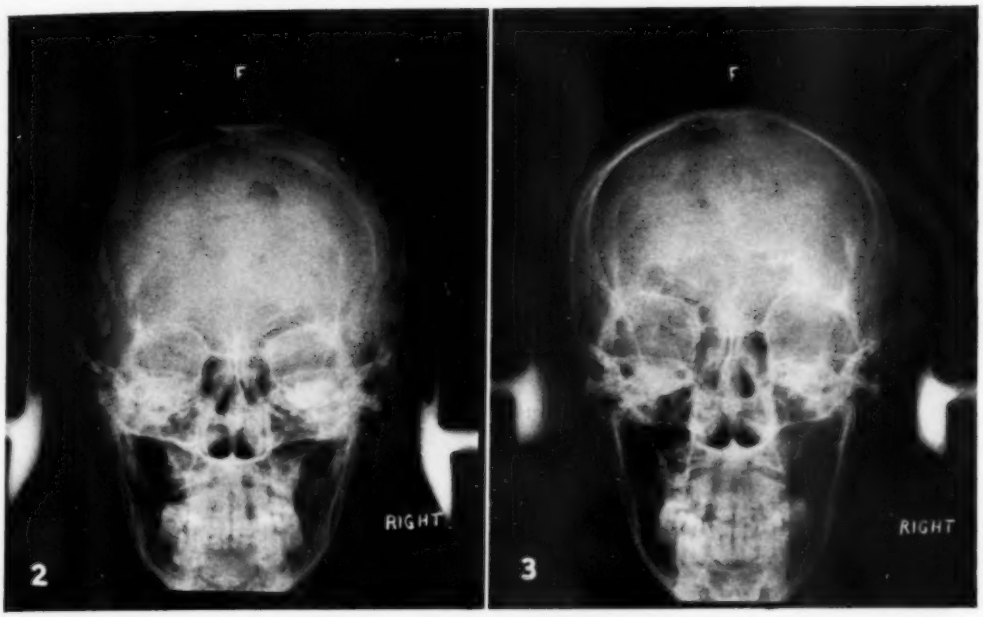

Fig. 2. Correctly labeled postero-anterior view of the head as shown by "F" marker.
Fig. 3. Mislabeled anteroposterior roentgenogram of the head as shown by "F" marker.

to the right side of the tube, and therefore of the observer, when the film is placed for interpretation so that the letter "F" can be read properly. Similarly, Figure 4 shows an unlabeled conventional anteroposterior roentgenogram of an ankle. That it represents the *right* ankle is deduced from the fact that with the film oriented as it was during the exposure, so that the letter "F" can be read properly, the image of the fibula corresponds to the observer's left and this is possible only if the right ankle was the one examined.

Until it is possible for cassette manufacturers to incorporate such a marker within the cassette, the radiologist can establish the same convention for himself by printing a capital letter "F" in ink on the border of the *back* intensifying screens of his cassettes. It is shown in Figure 5 written beside the cassette number. Thus, the letter "F" can be read properly only when the film is placed before him as it was before the x-ray tube during the exposure. It must be remembered, however, that a back screen so marked must never be substituted for a front screen, as this would reverse the image of the marker on the processed film and defeat the purpose of the identification. The "F" may, however, be printed backward (that is "ꟻ") on the border of a front screen. It is usually necessary to use the bright spotlight to observe the "F" when it is printed on the back intensifying screen.

Figure 6 shows a lateral roentgenogram of a *right* knee which is correctly labeled, for when the film is viewed from the "front side," as indicated by the letter "F," the image of the patella is to the left of the observer. The lateral side of the knee was toward the cassette, as shown by the sharp definition of the image of the head of the fibula. This example shows the appearance of the letter "F" when it is written in ink on the back screen of the cassette.

Figure 7 shows a roentgenogram of a *left* shoulder taken in the anteroposterior projection, which is mislabeled, for when the film is viewed from the "front side" the shadow of the humerus is to the right

Fig. 4. Unlabeled anteroposterior roentgenogram of a right ankle so oriented that the letter "F" can be read properly.

of the observer. This shows how the "F" appears when it is printed backward (that is "Ⅎ") on the front screen of the cassette.

Undoubtedly some radiologists make use of their system of numbering cassettes in orienting their films for interpretation. The image of the numbers customarily appears near a border of the roentgenogram, although frequently there is no uniformity in its location. Some are written on the back and some on the front intensifying screens. Furthermore, such numerals as 1, 6, 8, and 9 may be written so that it is impossible to be sure whether or not the image is perverted. It thus seems desirable for the radiologist to print a figure of reference such as that suggested on the back screen of his cassette in order that radiologists unfamiliar with these

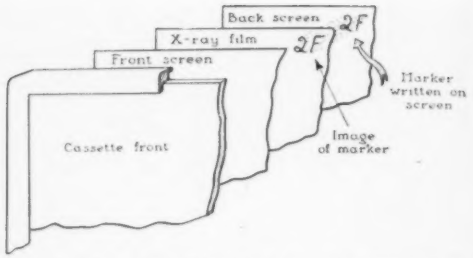

Fig. 5. Letter "F" printed in ink on the border of the back screen of the cassette.

particular cassettes can orient the films properly for interpretation.

The fact that markers used for identification of the cassette do not always appear on roentgenograms that have been partly masked by cones or lead shields offers no valid objection to the establishment of a system of marking. Provision always should be made for insuring the appearance of such markers on the completed roentgenogram so that the radiologist can identify the cassette used by inspection of the image of the screen number on his film.

SUMMARY AND CONCLUSIONS

The exact position of the patient during a roentgenographic exposure made with intensifying screens can be deduced if the roentgenogram is observed from the same side of the film as that of the x-ray tube during the exposure.

Since the position of the patient is thereby positively established, the patient's right and left sides are easily identified irrespective of the technician's film marker.

The use of an asymmetrical opaque marker such as the capital letter "F" permanently mounted in the cassette will insure the proper orientation of the film for interpretation and will consistently enable identification of the right and left sides.

Until the cassette manufacturers, some of whom already mount institutional or other identification markers in a manner similar to that we have described, can incorporate such a lead figure in the con-

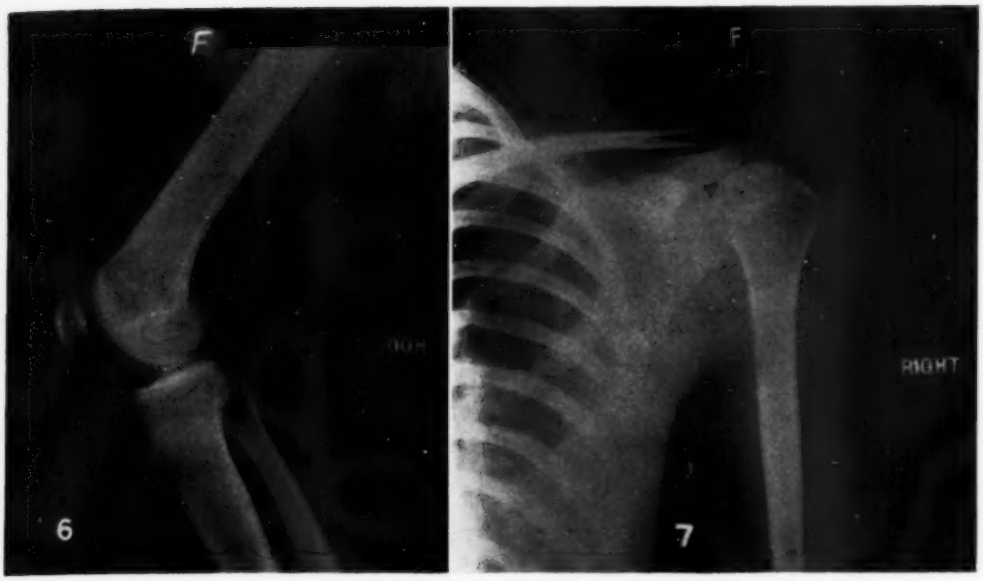

Fig. 6. Lateral roentgenogram of right knee correctly labeled as shown by "F" printed on the back screen of the cassette.

Fig. 7. Mislabeled roentgenogram of left shoulder as shown by "F" marker printed backward ("Ⅎ") on the front screen of the cassette.

struction of cassettes, the radiologist may accomplish the same purpose by printing the letter on a border of the back screen of each of his cassettes.

Similar provisions may be made for non-screen cassettes or other film exposure holders.

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SUMARIO

Identificación de los Lados Derecho e Izquierdo en las Radiografías por medio de un Marca-Chasis Permanente

Puede deducirse la posición exacta de un enfermo durante una exposición radiográfica verificada con pantallas intensificadoras si se observa la radiografía del lado de la película, correspondiente al del tubo de rayos X durante la exposición. Como la posición del enfermo queda así establecida positivamente, resulta fácil identificar los lados derecho e izquierdo del mismo, independientemente de la marca que usa el técnico en la película.

El empleo de una marca opaca asimétrica, como por ej. la letra capital "F," montada permanentemente en el chasis, garantizará la debida orientación de la película para interpretación y permitirá constantemente la identificación de los lados derecho e izquierdo. El radiólogo puede lograr el mismo fin imprimiendo la letra en un borde de la pantalla posterior de cada uno de sus chasis.

Pueden tomarse disposiciones semejantes tratándose de chasis sin pantallas o de otros portapelículas para exposición.

EDITORIAL

John Samuel Bouslog, M.D.

President of the Radiological Society of North America

Born in Logan, Ill., Oct. 13, 1890, John Samuel Bouslog had his elementary and high school education in Illinois and Oklahoma and his university and medical schooling in Colorado. Such a background must necessarily produce a true American with his whole life directed to the advancement of his country's welfare, especially in his own field of activity. Possessed of boundless energy, for years he has worked incessantly and tirelessly in behalf of organized medicine. He has served county, state, and national medical societies in developing and perfecting plans for voluntary health insurance, and he has been a potent influence in directing legislation toward better medical practices and controls. His work has been on local, state, and national levels, in both lay and medical circles. Now, at the halfway mark of the century, in his sixtieth year, he is climaxing his years of service to the profession as President of the Radiological Society of North America.

Quite early in his professional life Dr. Bouslog was made secretary of the Colorado State Medical Society and thus became interested in organized medicine. Since that time, he has worked constantly for its advancement. He served the society as constitutional secretary from September 1933 to February 1943, and during World War II, in the absence of the executive secretary, Mr. Harvey Sethman. From September 1937 to February 1943, he was chairman of the Board of Trustees of the society and in 1946 he was elected to the presidency to serve for the term of 1947–48. He is a member of the staff of St. Anthony's, Beth Israel, Children's, Colorado General, and St. Luke's Hospitals, and the Jewish Consumptive Relief Society and Swedish National Sanatorium.

Dr. Bouslog has exerted his influence, as he should, by membership and mingling in specialized and non-specialized groups. His hobbies center on wild flowers and birds and coin collecting. Among his numerous affiliations are: Acacia, Bird Club, Denver Chamber of Commerce, Colorado Mountain Club, Denver Athletic Club, Knights Templars, and Shrine. On the scientific side he is a diplomate of the American Board of Radiology, a fellow of the American Medical Association, the American College of Chest Physicians, and the American College of Radiology, and a member of the American Association for the Advancement of Science, the American Cancer Society, the American Radium Society, the American Roentgen Ray Society, the Denver County Medical Society, the Denver Radiological Club, and the Rocky Mountain Radiological Society.

His membership in these organizations has been and still is an active one, and he has held many offices, with vigor and loyalty. He has served as president of the Denver Radiological Club, president of the staff of St. Anthony's and Beth Israel Hospitals, and secretary of the staff of Children's Hospital, Denver. At the present time, he is Associate Clinical Professor of Radiology at the University of Colorado Medical School, Chairman of the Board of Chancellors of the American College of Radiology, Civilian Consultant in Radiology at Fitzsimons Army Hospital, and Vice-President of the Colorado Division of the American Cancer Society.

Dr. Bouslog has made excellent contributions to medical literature, especially in

John S. Bouslog, M.D.

President of the Radiological Society of North America

the field of roentgen studies of the gastrointestinal tract in children and in radiation therapy. During World War I, he was a member of Local and Medical Advisory Board 4 in Boulder, Colo., and during World War II, he was Radiologist and Secretary to Medical Advisory Board Number 1, Colorado, and Vice-Chairman of Procurement and Assignment of Colorado. He holds the rank of Surgeon in the U. S. Public Health Service Reserve.

Work of such value as Dr. Bouslog has done has been recognized. He has been the recipient of awards for twenty-five years of service on the faculty of the University of Colorado Medical School and certificates of merit from the Colorado State Medical Society for his contributions in directing the educational campaigns against socialized medicine.

The new President of the Radiological Society of North America has served the Society already as vice-president and member of the Board of Directors and is thoroughly conversant with its problems and policies. He is well equipped to carry on in a manner which will enhance the Society's value to both its members and the community.

W. WALTER WASSON, M.D.

The Thirty-sixth Annual Meeting

The Thirty-sixth Annual Meeting of the Radiological Society of North America, held in Chicago from Dec. 10 to 15, 1950, was remarkable in a number of ways. It was a well staged performance, by an evenly matched cast, and organized with a sense of timing that made it unusually gratifying.

An innovation which your reporter, and everyone to whom he talked, thinks worthy of commendation was the single session. There was no running, as in other years, from Diagnostic to Therapy Section, colliding with equally impatient members trying to beat the clock, finally arriving at the desired room to find that one had to climb over annoyed guests to get a seat to hear only the concluding paragraphs of the paper in which he was specially interested. The papers were well grouped, with a series of diagnostic subjects, a short intermission, and then a series of therapeutic papers, so that attendance could easily be guided by interest. The frequent change of presiding officers gave a convenient break and a spice of variety to each day. The decision to place two of the three business sessions in the middle of an afternoon's program, rather than at the end, resulted in a wholesome increase in attendance at those important meetings.

The effect of this change in custom was to make the meeting seem full but unhurried. There was time to get to and hear the papers in which one was particularly interested. There was time to visit the exhibits, and to inspect them without the feeling that something was being missed. There was more time to visit with the friends one had not seen since last year.

The one disadvantage of the one-session technic of program planning is that it limits the papers to about one-third the number usually given. Undoubtedly the Program Committee had the unhappy duty of rejecting some excellent papers which would be welcome in any program. This objection, however, is not a significantly practical one, for several reasons. In the past there have been frequent duplications, two or more papers reporting virtually the same experience. This is particularly true whenever there is something new being developed, as at present in the field of isotopes. RADIOLOGY is always available for publication of good papers, and here duplication may often be of real use, whereas at a meeting it is frequently time-consuming without advantage to the majority of listeners. The program this year was expertly balanced, with something for everyone, the specialist within our own

specialty, the general radiologist, and the student.

There is one headliner in every program, the Carman lecturer. This year it was Wendell G. Scott, M.D., of St. Louis, who chose as his subject "The Development of Cardiovascular Radiology." Dr. Scott is known to all but the deaf, dumb, and blind, and to some of those, because of the originality and excellence of his previous papers. As Carman lecturer he well demonstrated the excellent choice of the Program Committee. Dr. Carman would be pleased to see the list of distinguished radiologists who have given the lectures commemorating him, and would be delighted at the steady and sometimes spectacular advance that radiology has made in the course of the years.

Dr. Warren Furey, retiring President, handing over the gavel to Dr. John Bouslog, incoming President

The Society was rich this year in having two Gold Medalists. Even Dr. Childs, who watches the extravagances of the Board of Directors with an economical eye, must have been pleased. Dr. James T. Case of Chicago and Dr. Howard P. Doub were the recipients. The Society is indeed fortunate in having two such men to honor, men who have contributed so much to the scientific advancement of radiology, who have given so much of themselves to the guidance and development of the Society, and whose friendship has enriched the lives of so many.

Presentation of the Gold Medal of the Society. Standing, left to right, Dr. John Bouslog, Dr. Howard P. Doub, Dr. Warren W. Furey, Dr. James Case. Seated, Mrs. Warren W. Furey.

The Nominating Committee did a good job, too, this year. They, of course, are always threatened by nominations from the floor, but so long as they continue to use the kind of discretion they used this year the danger is not great. Their candidates deserved nomination for their long service to the Society and can be depended upon to carry on in an even better fashion than they have in the past. The lucky fellows were: President-Elect Dr. Joseph C. Bell, Louisville, Ky.; First Vice-President, Dr. John H. Gilmore, Chicago, Ill.; Second Vice-President, Dr. Ivan M. Woolley, Portland, Ore.; Third Vice-President, Dr. Edward A. Petrie, New Brunswick, Canada; Member of the Board of Directors, Dr. Clarence E. Hufford, Toledo, Ohio, and the perennial winning candidates: Secretary-Treasurer, Dr. Donald S. Childs, Syracuse, N. Y., and Librarian, Dr. Howard P. Doub, Detroit, Mich.

In spite of the fact that the meeting had to be held a week late because of a conflict of dates with another but hardly more important meeting, members and guests flocked to Chicago, registering to the number of

two thousand eighty five. Count 'em—2,085! After all, it is the members and guests who make the meeting. A registration such as this is the ultimate and final tribute to the officers, essayists, refresher course givers, and exhibitors who do the work.

Lest your reporter be accused of throwing nothing but soft soap, he will throw one soft brickbat. There has been a notable decline in the quality and quantity of discussion. No discussant should take this as a personal attack; there were many good discussions; there just weren't enough of them. For a number of years, under the pressure of the clock, discussion has decreased, until it is now little more than a formality. Something has been gained and lost in the process. We all remember the days when occasionally a discussant would give another whole paper, complete with slides and tables. These we should eschew like the plague. But something of value is lost when time is lacking for discussion for emphasis or questions for information or clarification.

There are always numerous unprogrammed activities that contribute to the success of a meeting. There were lots of these, including *South Pacific* (no discussion or questions), which was enjoyed by many. There were the breakfasts, lunches, and dinners with old friends. There was the work of the Ladies' Entertainment Committee, which never gets enough public acknowledgment. For all these, and the successful solution of many difficult problems, known only to the officers, Program and Local Committees, we say thank you; finally showing our appreciation by counting on coming again next year.

SYDNEY J. HAWLEY, M.D.

The Refresher Courses

The Refresher Courses at the Thirty-sixth Annual Meeting continued to attract the attention of many men seeking to review and to obtain new ideas in the various sections of Radiology.

A total of 862 registered for the courses, including 501 members, 226 guests, and 135 residents. They came from all of the 48 states, all the provinces of Canada, and seven other foreign countries.

There were many expressions of appreciation of the speakers and their courses, and the Refresher Course Committee would like to take this opportunity to thank all of the lecturers whose names are listed below:

James W. J. Carpender, M.D.
Anna Hamann, M.D.
Irving Hummon, M.D.
Herbert Schmitz, M.D.
Danley P. Slaughter, M.D.
Eric Uhlmann, M.D.
T. J. Wachowski, M.D.
Earl E. Barth, M.D.
Edith H. Quimby, Sc.D.
Simeon T. Cantril, M.D.
Wilbert H. McGaw, M.D.
Maurice D. Sachs, M.D.
Robert P. Ball, M.D.
Aubrey O. Hampton, M.D.
Robert D. Moreton, M.D.
Earl R. Miller, M.D.
Edward B. D. Neuhauser, M.D.
Laurence L. Robbins, M.D.
Leo G. Rigler, M.D.
S. A. Lovestedt, D.D.S.
A. A. deLorimier, M.D.
Douglas Quick, M.D.
Frederic E. Templeton, M.D.
George C. Henny, M.D.
William Harris, M.D.
Vincent W. Archer, M.D.
E. C. Baker, M.D.
Otto Glasser, Ph.D.
Fred Jenner Hodges, M.D.
Melvin M. Figley, M.D.
Walter M. Whitehouse, M.D.
Carl L. Gillies, M.D.
Robert P. Barden, M.D.
Ross Golden, M.D.
Lois C. Collins, M.D.
Harold Wm. Jacox, M.D.
J. R. Hodgson, M.D.
R. L. J. Kennedy, M.D.
C. C. Birkelo, M.D.
Agrippa G. Robert, M.D.

We would like also to thank the Chicago Roentgen Ray Society Refresher Course Committee, especially the Chairman, Dr. Benjamin Braun, who helped so materially to make this meeting a success.

REFRESHER COURSE COMMITTEE
Kenneth S. Davis, M.D.
Paul C. Swenson, M.D.
C. Edgar Virden, M.D., Chairman

The Scientific Exhibits

It appeared to be a matter of common consent at the 1950 meeting of the Radiological Society of North America, held at the Palmer House in Chicago, that the Scientific Exhibits were of unusually fine quality. Several features contributed to this feeling. The originality, unique presentation, and teaching value of most of the exhibits were outstanding. The new fluorescent-lighted viewing boxes purchased by the Society this year contributed in a large measure to the attractiveness of the material. Single session meetings allowed more time for the members to study exhibits carefully.

The arrangement and direction of the exhibitors' spacing were most skillfully handled by the Scientific Exhibits Committee of the Society under the secretaryship of Dr. Ivan Miller of San Francisco, with the assistance of the local Exhibits Committee headed by Dr. Robert Arens.

There were 46 exhibits with 108 exhibitors and associates. In addition, nine gadgeteers displayed their handiwork.

Seven awards were made in the regular exhibit and one in "Gadget Row."

The first award was given to Charles T. Dotter, M.D., Bronson S. Ray, M.D., and Howard S. Dunbar, M.D., of New York City for their exhibit on *Dural Sinus Venography: A New Roentgen Technic.*

There was a tie for second award and consequently two were given. One of these went to a group of six from Chicago, Leon O. Jacobson, M.D., Edna K. Marks, Evelyn O. Gaston, B.S., Melba Robson, B.S., Eric L. Simmons, Ph.D., and William F. Bethard, M.D., for their work on *The Role of the Spleen in Radiation Injury.*

The other second award was given to Russell L. Nichols, M.D., and James W. J. Carpender, M.D., of Chicago for their studies of dose distribution in *Treatment of Carcinoma of the Cervix.*

The third award went to L. Reynolds, M.D., K. E. Corrigan, Ph.D., and H. S. Hayden, Ph.D., of Detroit for their exhibit on *Diagnostic Studies with Radioactive Isotope Tracers.*

Three exhibits were granted Honorable Mention: *Ameloblastoma*, by Frank C. Binkley, M.D., and George S. Sharp, M.D., of Pasadena, Calif.; *Medical Application of the Betatron*, by Roger A. Harvey, M.D., John S. Laughlin, Ph.D., and Lewis L. Haas, M.D., of Chicago; *The Diagnosis of Intrathoracic Lymph Node Metastasis in Carcinoma of the Lung*, by James J. McCort, M.D., and Laurence L. Robbins, M.D., of Boston.

In "Gadget Row," a first award was made by a separate judging committee. This went to Dr. Roscoe G. Van Nuys of Berkeley, California, for his hobby-horse cassette holder designed to help simplify chest radiography in small children.

The task of the award committees was extremely difficult because of the high standard of all exhibits and the uniqueness and practicability of the gadgets.

The following list of the exhibits is in alphabetical order of exhibitors:

"Bone, Joint and Soft Tissue Changes in Pelvis and Lower Extremities of Paraplegics," MARTIN S. ABEL, M.D., Oakland, Calif.

"Protective Value of Various Aprons. A Comparison by Physical Measurements," WILLIAM S. ALTMAN, M.D., Quincy, Mass., AND CHARLES K. SPALDING, M.D., Boston, Mass.

"American Society of X-ray Technicians," VERNON E. JOHNSON, Sioux Falls, S. Dak.

"X-rays of the Chest," DAVID S. BEILIN, M.D., JACK P. FINK, M.D., AND LAWRENCE W. LESLIE, M.D., Chicago, Ill.

"Simultaneous Planeography," A. L. L. BELL, M.D., A. E. BAUM, M.D., AND H. O. WUNDERLICH, M.D., Brooklyn, N. Y.

"Abdominal Arteriography," JOSEPH C. BELL, M.D., DAVID SHAPIRO, M.D., EVERETT L. PIRKEY, M.D., AND JAMES B. DOUGLAS, M.D., Louisville, Ky.

"Ameloblastoma," FRANK C. BINKLEY, M.D., AND GEORGE S. SHARP, M.D., Pasadena, Calif.

"Hysterography as a Diagnostic Procedure in the Examination of the Uterine Cavity," IGNACIO BIRD, M.D., Greensboro, N. C.

"Dural Sinus Venography: A New Roentgen Technic," CHARLES T. DOTTER, M.D., BRONSON S. RAY, M.D., AND HOWARD S. DUNBAR, M.D., New York, N. Y.

"Single Unit Expanding Radium Applicator," EDWIN C. ERNST, M.D., St. Louis, Mo.

"Translumbar Arteriography," ARTHUR T. EVANS, M.D., PARKE G. SMITH, M.D., EDWARD C. ELSEY, M.D., AND BENJAMIN FELSON, M.D., Cincinnati, Ohio.

"The Value of Soft-Tissue Technics and Tomography in the Diagnosis and Treatment of Head and Neck Tumors," GILBERT H. FLETCHER, M.D., AND KAROL E. MATZINGER, M.D., Houston, Texas.

"Biological Phenomena Following X-Radiation," ANNA GOLDFEDER, D.Sc., New York, N. Y.

"Mechanism of Skull Fracture," E. S. GURDJIAN, M.D., J. E. WEBSTER, M.D., AND H. R. LISSNER, Detroit, Mich.

"Lipoid Pneumonia Simulating Carcinoma of Lung," AUBREY O. HAMPTON, M.D., EDWARD B. MCCABE, M.D., THEODORE WINSHIP, M.D., AND EDGAR W. DAVIS, M.D., Washington, D. C.

"Pulmonary Artery Thrombosis, JOSEPH HANELIN, M.D., AND WILLIAM R. EYLER, M.D., Boston, Mass.

"Medical Application of the Betatron," ROGER A. HARVEY, M.D., JOHN S. LAUGHLIN, PH.D., AND LEWIS L. HAAS, M.D., Chicago, Ill.

"Reticulo-Endotheliosis (Hand-Schüller-Christian Disease)," J. R. HODGSON, M.D., R. L. J. KENNEDY, M.D., AND JOHN D. CAMP, M.D., Rochester, Minn.

"Osseous Lesions in Tuberous Sclerosis," JOHN F. HOLT, M.D., AND WILLARD W. DICKERSON, M.D., Ann Arbor, Mich.

"Pulmonary Conditions of Occupational Origin," JAMES P. HUGHES, M.D., Cincinnati, Ohio, AND CARROLL C. DUNDON, M.D., Cleveland, Ohio.

"Plastic Electrical Model of X-ray Machine," LINNEUS G. IDSTROM, M.D., Minneapolis, Minn.

"The Role of the Spleen in Radiation Injury," LEON O. JACOBSON, M.D., EDNA K. MARKS, EVELYN O. GASTON, B.S., MELBA ROBSON, B.S., ERIC L. SIMMONS, PH.D., AND WILLIAM F. BETHARD, M.D., Chicago, Ill.

"Congenital Anomalies of the Urinary Tract," L. L. KLOSTERMYER, M.D., AND MEREDITH F. CAMPBELL, M.D., Montclair, N. J.

"Pelvimetry: Advantages of Compensating Filters and Examination in the Standing Position," KARL K. LATTEIER, M.D., AND ALBERT E. SMITHERAM, M.D., Detroit, Mich.

"Normal and Abnormal Biliary System," JOSEPH J. LITSCHGI, M.D., Chicago, Ill.

"A Practical Mode for Accurate Therapy," JESSHILL LOVE, M.D., W. A. ASKEW, M.D., G. N. COMBS, M.D., AND M. HARCOURT, A.B., Louisville, Ky.

"Physiologic and Clinical Applications of Electrokymography," ALDO A. LUISADA, M.D., AND J. ARENDT, M.D., Chicago, Ill., AND F. G. FLEISCHNER, M.D., AND M. M. SHEPERMAN, M.D., Boston, Mass.

"Uniform Contact Roentgen Radiation for Large Areas," EUGENE F. LUTTERBECK, M.D., AND IRVING HUMMON, M.D., Chicago, Ill.

"Hysterography and Hysterosalpingography in the Diagnosis of Intra-uterine and Intratubal Lesions," RICHARD H. MARSHAK, M.D., ARTHUR DAVIDS, M.D., AND MORRIS A. GOLDBERGER, M.D., New York, N. Y.

"Improved Pediatric Excretory Urography," LOUIS P. MATTHEI, M.D., Salt Lake City, Utah.

"The Diagnosis of Intrathoracic Lymph Node Metastasis in Carcinoma of the Lung," JAMES J. MCCORT, M.D., AND LAURENCE L. ROBBINS, M.D., Boston, Mass.

"Accessory Equipment for Lateral Radiography of the Hip Joint," E. F. MERRILL,

M.D., H. B. CRAWFORD, M.D., AND C. F. BRIDGMAN, Rochester, N. Y.

"Comparative Skin Effects of 'Identical' Gamma Roentgen Doses of Cobalt 60 and Radium," I. MESCHAN, M.D., A. NETTLESHIP, M.D., AND E. S. KEREKES, M.D., Little Rock, Ark.

"The Diagnosis and Localization of Brain Tumors with Radioactive Diiodofluorescein," GEORGE E. MOORE, M.D., AND MOSES ASHKENAZY, M.D., Minneapolis, Minn.

"Arteriography in General Radiological Practice," R. C. MOORE, M.D., and HOWARD B. HUNT, M.D., Omaha, Nebr.

"The Use of Co^{60} in Interstitial Radiation Therapy," JOSEPH L. MORTON, M.D., GEORGE W. CALLENDINE, M.S., AND WILLIAM G. MYERS, Ph.D., Columbus, Ohio.

"Treatment of Carcinoma of the Cervix," RUSSELL L. NICHOLS, M.D., AND JAMES W. J. CARPENDER, M.D., Chicago, Ill.

"A New Teaching Aid in Diagnostic Roentgenology," EVERETT L. PIRKEY, M.D., FRANK W. SHOOK, JR., AND JAMES E. PARKER, JR., A. B., Louisville, Ky.

"Diagnostic Studies with Radioactive Isotope Tracers," L. REYNOLDS, M.D., K. E. CORRIGAN, PH.D., AND H. S. HAYDEN, PH.D., Detroit, Mich.

"Prostatography," S. A. ROBINS, M.D., AND M. L. BRODNY, M.D., Boston, Mass.

"Hodgkins Disease of the Lung," BERNARD ROSWIT, M.D., AND LEWIS L. LAWRENCE, M.D., Bronx, N. Y.

"Bronchogenic Carcinoma and Conditions to be Differentiated from It," JOE C. RUDE, M.D., AND CAROLINE W. ROWE, M.D., Galveston, Texas.

"Pulmonary Metastases: Incidence, Characteristics and Prognosis," PETER E. RUSSO, M.D., Oklahoma City, Okla.

"Microradiography," WALLACE S. TIRMAN, M.D., CHARLES E. CAYLOR, M.D., AND HARRY S. BANKER, M.D., Bluffton, Ind.

"The Use of Laminography in Various Diagnostic Problems," EGON G. WISSING, M.D., AND EMANUEL HORWITZ, M.D., West Roxbury, Mass.

The exhibits of the Gadgeteers were as follows:

Improved vaginal applicators of the Manchester System, J. GERALD HOCKIN, M.D., Los Angeles, Calif.

Mobile processing tank unit, WALLACE D. BUCHANAN, M.D., South Bend, Ind.

Multiple aperture diagnostic cone, CESARE GIANTURCO, M.D. Urbana Ill.

CO_2 for double contrast enema, J. L. MORTON, M.D., Columbus, Ohio.

Film identification marker, W. S. ALTMAN, M.D., Quincy, Mass.

(1) Remote control electronic timer for the dark room; (2) Impulse counter for checking x-ray exposures; (3) A small motor, E. G. ESCHNER, M.D., and R. B. STEVENSON, M.D., Buffalo, N. Y.

Electric remotely controlled flow regulator for barium enema solutions, COLIN B. HOLMEN, M.D., Rochester, Minn.

(1) Developing unit and solutions for rapid processing of x-ray films; (2) Modified compression clamp for skull radiography, JOHN D. CAMP, M.D., Rochester, Minn.

Hobby-horse cassette holder, ROSCOE G. VAN NUYS, M.D., Berkeley, Calif.

RADIOLOGICAL DEFENSE EXHIBIT

A splendid exhibit on radiological defense was made possible through the cooperative efforts of Captain C. F. Behrens, M.C., U. S. Navy, Director of Defense Division of the Bureau of Medicine and Surgery, Navy Department, Colonel Kurt M. Landon, U. S. Air Force, Armed Forces Institute of Pathology, and the Armed Forces Special Weapons Project.

Trained personnel, U. S. Army enlisted men, accompanied the exhibit and demonstrated its features. This was done in the manner planned for training military personnel in radiological defense.

The Scientific Exhibits again fulfilled their part in the annals of the interesting and instructive Annual Meetings of the Radiological Society of North America.

C. E. HUFFORD, M.D., *Chairman*
Scientific Exhibits Committee

The Commercial Exhibit

The Commercial Exhibit of the Thirty-sixth Annual Meeting of the Radiological Society of North America was one of the best ever held. Both exhibitors and Society members were pleased with the physical arrangements and enjoyed the new products shown.

AMPEREX ELECTRONIC CORPORATION (*Brooklyn, N. Y.*) displayed its line of x-ray tubes. The featured item was a rotating anode tube with a focal spot of 0.3 mm. The fine detail radiographs made with this tube were demonstrated in the exhibit of the North American Philips Company.

ANSCO CORPORATION (*Binghamton, N. Y.*) presented routine roentgenographs on the new Ansco high-speed film. In addition, they displayed the pineal calculator and demonstrated its use. Current aids to the radiologist, in the form of books (on radium and radioactive isotopes, by Dr. Quimby; on x-rays, by Dr. Howes), the H-H sella meter, non-screen exposure guide, and the x-ray exposure calculator were also shown.

AUTOMATIC SERIOGRAPH CORPORATION (*College Park, Md.*) exhibited the latest model of its machine designed for automatically controlled serial exposures during angiography of the brain, heart, lung, kidney, and extremities. This can be used with standard x-ray equipment and is sufficiently mobile so that it can be used in different institutions. Exposures at intervals ranging from one-half to two seconds or longer can be obtained.

BUCK X-OGRAPH COMPANY (*St. Louis, Mo.*) displayed a new type of film-filing cabinet, with hinged front doors meeting in the center and an inner film holder which slides forward about 6 inches, within which the films are stacked vertically between dividing spacers. The long dimension of the film is parallel to the floor, permitting handling at a greater height than in the usual drawer-type file cabinet.

COCA-COLA COMPANY (*Atlanta, Ga.*) graciously contributed its wares to all and sundry, relieving the parched throats of the thirsty and giving that needed "pick-up" to the fatigued. Over 6,500 bottles of Coca-Cola were dispensed during the course of the meeting.

CORECO RESEARCH CORPORATION (*New York, N. Y.*) showed its Coreco camera, designed to photograph all surfaces of the body and all readily available cavities. Areas from 2 × 2 inches to one-half body size are portrayed on bantam-size film. A fully color-corrected lamp and a mechanism for control of the color temperature and exposure, as well as automatic focusing, were featured.

DUNLEE CORPORATION (*Chicago, Ill.*) displayed its complete line of x-ray and valve tubes, all incorporating a getter to provide stable gas-free performance, even under overload conditions. Also shown was their new development of self-rectified tubes possessing rectified ratings. This improvement was made possible by a new geometry for a line focus type of stationary anode tube.

E. I. DU PONT DE NEMOURS COMPANY (*Wilmington, Del.*) exhibited radiographs with half of each film in color. Red, green, yellow, and blue were used to determine what, if any, would be the physiological and psychological effect of color on roentgenographic contact. Radiologists were invited to indicate by ballot which color contributed to better diagnostic viewing.

EASTMAN KODAK COMPANY (*Rochester, N. Y.*) presented medical radiographs on Kodak Blue Brand Film, made to demonstrate the quality obtainable with Kodak Contact X-ray Screens and Kodak chemicals for x-ray processing—the "radiographic rule-of-three." Special radiographic sections demonstrated intensification of the occasionally under-exposed radiograph in Kodak In-6 solution; films as much as 1/7 exposed can be made to reveal diagnostic detail which can be read immediately or copied for archival purposes.

ELDORADO MINING & REFINING COMPANY, LTD. (*Ottawa, Canada*), featured a scale model of the Co^{60} beam therapy unit, under development by Eldorado. The equipment will allow use of the gamma ray beam from about 2,500 curies of Co^{60} for deep therapy, giving a dosage rate of 30 roentgens per minute, at a treatment distance of one meter. Production is scheduled for 1951.

EUREKA X-RAY TUBE CORPORATION (*Chicago, Ill.*) displayed the latest development in light-weight rotating anode tube units, the RA "53." This 16-pound rotator is furnished with either 45° or horizontal cable arms and is designed for self-rectified service using 100 ma. at 90 kv.p. for 2 3/4 seconds. Also shown were various types of motor control units which are available for the RA "53" and the intermediate-weight rotating anode tube unit, the RA "51." Other rotating anode tube units, stationary anode units, and insert tubes were displayed.

FAIRCHILD CAMERA AND INSTRUMENT CORPORATION (*Jamaica, N. Y.*) showed the new type F-280-A roll-film cassette, for cerebral angiography, angiocardiography, and other types of serial radiography. This unit includes a number of new features, among which is the Synchrotrol for setting the rate of serial operation. A model of the new Reflection type Fluoro Record camera was also shown. This camera is equipped with an extremely fast optical system, rated at F-67, and is capable of making photo x-ray exposures at six times the optical speed of the standard F-212 camera, used for tuberculosis surveys.

H. G. FISCHER & COMPANY (*Franklin Park, Ill.*) exhibited a combination diagnostic and superficial therapy unit, with two tubes. The diagnostic rating is 250 ma. at 100 kv.p., using a rotating anode tube above the table and a stationary anode tube underneath. The therapy rating is 5 ma. at 125 kv.p. The table is motor-driven and the tube stand is mounted on floor rails. A floor-to-ceiling stand is optional. Control is of the panel type and semi-automatic on both tubes, including spot-film features. The background of the booth consisted of photo enlargements of various other units of the company's line.

GENERAL ELECTRIC X-RAY CORPORATION (*Milwaukee, Wis.*) displayed the Precision Ordographic Device, hydraulically operated at variable speeds for layer radiography in both the vertical and horizontal planes, giving variations in slice thickness from 1.3 mm. to approximately 3 cm. The smooth operations of this device have produced a high-quality radiograph. Also shown was the KX-16, gas-insulated, full-wave rectified 100 ma. at 100 kv.p. transformer for two tube operation, and the KR-8 Kenotron Rectifier, new in design, for gas-insulated transformers. An answer to the question of spot-film selectivity was offered through the displaying of the Maxiscope 500 table, with floor-to-ceiling tube stand and a choice of several spot-film devices adaptable to General Electric tables.

GRUNE & STRATTON, INC. (*New York, N. Y.*), showed for the first time Volume I of a five-volume set of the monumental work on Roentgen Diagnosis, by Drs. Schinz, Baensch, Friedl, and Uehlinger, for which Dr. James T. Case has arranged the English edition. Two hundred other titles included the second revised edition of Clark's *Positioning in Radiography*, Storch's *Fundamentals in Fluoroscopy*, and Veillon's *Medical Dictionary in Three Languages* (English, German, and French).

PAUL B. HOEBER, INC. (*New York, N. Y.*) displayed its full list of medical books. Of particular interest were Ritvo's *Roentgen Diagnosis of Diseases of the Skull*, Ferguson's *Roentgen Diagnosis of the Extremities and Spine*, Coley's *Neoplasms of Bone*, Kaplan's *Clinical Radiation Therapy*, and Schwedel's *Clinical Roentgenology of the Heart*. Much interest was shown in Dotter and Steinberg's *Angiocardiography*, announced for the first time at the meeting.

INTERNATIONAL MEDICAL RESEARCH COMPANY (*New York, N. Y.*) exhibited the new Bucky automatic color camera. This

camera, which adjusts itself by optical means, takes color photographs of the fundus of the eye, body cavities, body surfaces, and also images from the fluoroscopic screen. Also shown was the Bucky combination therapy apparatus, which produces x-ray radiation up to 80 kv. continuous use, contact and grenz-ray therapy. This unit, which is completely mobile, has no high-tension cables and requires no installation, not even a special line.

KELLEY-KOETT MANUFACTURING COMPANY (*Covington, Ky.*), celebrating its golden anniversary, displayed its Mounted Tubecrane. The new Kelley-Koett teleradiographic unit, the new 250-kv., 15-ma. constant potential therapy unit, and a 500-ma. Multicron, with photo-timer, also were shown. An angiographic unit, capable of eight exposures per second on film of various sizes up to 3 ft. in one dimension, feeding from a large roll, was demonstrated.

LEA AND FEBIGER (*Philadelphia, Penna.*) featured at their exhibit four 1950 publications: Davidoff and Epstein's *The Abnormal Pneumoencephalogram;* Pohle's *Clinical Radiation Therapy,* a new second edition; Holmes and Schulz's *Therapeutic Radiology;* and Wesson's *Urologic Roentgenology,* new third edition. They also presented advance information regarding two early 1951 publications: Ritvo's *Chest X-ray Diagnosis* and Davidoff and Dyke's *The Normal Encephalogram,* new third edition.

LIEBEL-FLARSHEIM COMPANY (*Cincinnati, Ohio*) displayed items from their regular line of x-ray specialty devices, including x-ray grids, the Bantam Bucky, the new 1/20 to 14 seconds x-ray timer, and the new 1/60 to 14 seconds impulse type x-ray timer. This latter item, known as the Thyr-X Timer, is now available in de luxe x-ray controls produced by four of the six leading x-ray equipment manufacturers.

MACHLETT LABORATORIES, INC. (*Springdale, Conn.*) had on display a complete line of rotating anode tubes, with a model for each class of apparatus. The most powerful model shown was the "Super Dynamax" for use at voltage up to 125 kv. p., where heavy exposures in rapid sequence are required. Also shown were the new Dynamax "20," a small rotating anode tube designed for use on light-weight tube stands, along with the under-table tube, the Dynamax "26," and its companion, the Dynamax "25," an all-purpose tube for general radiography.

MALLINCKRODT CHEMICAL WORKS (*St. Louis, Mo.*) featured a new contrast medium for urography, Urokon ® Sodium 30 per cent, brand of Sodium Acetrizoate, accepted by the Council on Pharmacy and Chemistry, American Medical Association. This new medium for excretory and retrograde urography combines the important properties of low toxicity, few side reactions, high-quality pyelograms, and quick pictures to achieve a new high level of performance for the radiologist and urologist. Also shown were Barium Sulfate U.S.P. XIV, for x-ray diagnosis, and Hippuran R N.N.R.

F. MATTERN MANUFACTURING COMPANY (*Chicago, Ill.*) displayed their new 250-kv. constant potential deep therapy x-ray unit, which offers outstanding features of maneuverability, unusually compact tubehead, maximum versatility, and simplicity of operation. Also on display was the latest in 200-ma. diagnostic equipment, using photoelectric timing.

MICRO X-RAY RECORDER, INC. (*Chicago, Ill.*) showed the micro x-ray recorder, designed for the teaching field and the reduction of x-ray film storage space, 500 to 1. Each 100 ft. of 35 mm. roll of film will hold over 1,500 radiographs, closely controlled as to densities and diagnostic detail. Exposure factors are controlled automatically.

NATIONAL SYNTHETICS, INC. (*New York, N. Y.*) featured a new contrast agent, Monophen, for gallbladder visualization. This they claim is diagnostically reliable and unusually free of such complaints as dysuria, diarrhea, and cramps. Six capsules (3 grams) are adequate for average-

weight patients. Other products displayed were Cholex and Baropaque.

THOMAS NELSON & SONS (*New York, N. Y.*) placed special emphasis on three books: Portmann's *Clinical Therapeutic Radiology*, Golden's *Diagnostic Roentgenology*, and Behrens' *Atomic Medicine*. In addition to the above mentioned titles, the complete Nelson line of books relating to medicine was displayed.

NORTH AMERICAN PHILIPS CORPORATION (*Mt. Vernon, N. Y.*) had an interesting display of "Enlargement" radiographic technic, by direct exposures, up to three times the normal size, utilizing a large object-film distance, and their new 0.3 mm. focal spot on a double-focus rotating anode tube. Also shown were a constant potential 200-kv. therapy unit, featuring great flexibility because of a small size tube head, and the Philips Compactix, a self-contained self-rectified unit, mounted on a Gantry stand, operating at 210 kv. and 12 ma. The familiar Philips Contact and Cavity 50-kv. therapy unit was also to be seen.

THE PAKO CORPORATION (*Minneapolis, Minn.*) displayed automatic chemical replenishing valves, chemical circulation and filtration equipment, as well as mixing and storing facilities, which can be used with either automatic or manual film processing procedures. The new Pako Model 38 Filmtanx enables an approach by manual control to the accuracy of automatic processing.

PICKER X-RAY CORPORATION (*New York, N. Y.*) showed the new motor-driven 45° Trendelenburg Constellation Table, featuring all magnetic locks. The Pictronic "500" Control, equipped for electronic timing, high kilovoltage radiography and photo-timing was also displayed. A new rigid wall-mounted Potter-Bucky diaphragm stand, complete with reciprocating Bucky and adaptable to photo-timing, was introduced. This stand provides flexibility for head and vertical technics. It may also be used under a hospital cart. A 24,000,000-volt Allis-Chalmers Betatron was demonstrated for the first time at a medical meeting.

RADIOLOGY (*Detroit, Mich.*), the official journal of the Radiological Society of North America, illustrated by a series of panels the process of creating the reproductions of roentgenograms which appear in its pages. A leaflet suggesting what the author can do toward better illustrations and copies of the latest issue of RADIOLOGY were distributed.

RADIUM CHEMICAL COMPANY, INC. (*New York, N. Y.*) displayed standard types of instruments and accessories for the handling and application of radium and radon. Also, the Ernst type cervical uterine applicator and the Hankins-Hockin plastic ovoids and nylon intrauterine tubes, for which this company is sole distributor, were demonstrated.

FRANK SCHOLZ X-RAY ENGINEERING SERVICE, INC. (*Boston, Mass.*) showed the latest Scholz 6 in 1 spot-film device in two models, one equipped with timing dial for density control on the spot-film device and one with photo-tube timing. They also showed a complete screen staging especially designed for the Scholz 6 in 1 spot-film device, of extremely light and rugged design.

STANDARD X-RAY COMPANY (*Chicago, Ill.*), displayed its 250-kv. Flexray Constant Potential Therapy Apparatus, featuring extreme flexibility, high output, and superior radiation quality. Vernier controls are used. Also shown was the Standex Line of diagnostic apparatus available in capacities of 60, 100, 200, 300 and 500 ma.

TRACERLAB, INC. (*Boston, Mass.*), exhibited radiation therapy sources and a complete line of radiation detection and measurement equipment. Radiocobalt, for interstitial and intracavitary therapy, and a working model of a multicurie beam therapy unit were featured, as well as a Strontium-90 Beta-Ray applicator, which delivers about 20 equivalent roentgens per second. Instrumentation included film badge service for measurement of personnel radiation exposure, as well as civil defense, clinical, and laboratory instruments.

CHARLES C THOMAS, PUBLISHER (*Springfield, Ill.*) presented new books in the field

of radiology: Cantril's *Radiation Therapy in the Management of Cancer of the Uterine Cervix*, Low-Beer's *Clinical Use of Radioactive Isotopes*, Luck's *Bone and Joint Diseases: Pathology Correlated With Roentgenological and Clinical Features*. There was much interest in the announcement of Frimann-Dahl's *Roentgen Examination in Acute Abdominal Diseases*, to be published early in 1951.

WEBSTER PHOTOCRAFT (*Webster Groves, Mo.*) showed the new method of medical illustration by means of an atlas of miniature roentgenographs. These were on 2 3/4 × 4-inch films, with a description of each illustration photographed on the film. Also featured was the Master X-ray Vugraph, a portable projector, with a 10 × 10-inch viewing surface capable of projecting original x-ray films and having magnifying lenses for use with lantern slides. The X-ray Vugraph, with which full 14 × 17-inch x-ray films can be shown was also demonstrated.

WINTHROP-STEARNS INC. (*New York, N. Y.*) showed illustrations of films made using Diodrast for direct cholangiography and angiocardiography and Skiodan for retrograde pyelography. Literature describing methods of use and doses of these products was available.

WESTINGHOUSE ELECTRIC CORPORATION (*Pittsburgh, Penna.*) made the first showing of the Fluoricon tube, used with the Fluorex, a complete Electronic X-ray Amplifier, designed to raise the illumination of the fluoroscopic image many times, as compared to present-day screens. Also shown were x-ray accessories, a wall-mounted tube stand for superficial therapy, the Dual Dermadex control, a Reliance table, a single-column tube stand for deep therapy, a 500-ma. control, a 250-kv. therapy control, a 300-ma. control, a head x-ray unit of the Lysholm type, an exposure monitor, and a rail-mounted tube stand.

WOLF X-RAY PRODUCTS, INC. (*New York, N. Y.*) exhibited their complete line of x-ray accessories. The high lights of the exhibit were Superflex gloves and Supertex aprons.

YEAR BOOK PUBLISHERS (*Chicago, Ill.*) showed a number of volumes relating to the field of Radiology. Those of greatest interest were the new edition of Caffey's *Pediatric X-ray Diagnosis*, the *1950 Year Book of Radiology*, Volume 2 of *Medical Physics*, the six *Handbooks of Roentgen Diagnosis*, and Hodges, Holt, and Lampe's *Radiology for Medical Students*.

T. J. WACHOWSKI, M.D., *Chairman*
Commercial Exhibit Committee

Special Notice

Radiological Society of North America

At the Thirty-sixth Annual Meeting of The Radiological Society of North America, Inc., the Membership voted to change the By-laws of the Society so that the deadline for accepting applications shall be at least six months prior to the annual meeting. In 1951 the deadline for accepting applications will be June 2, 1951.

ANNOUNCEMENTS AND BOOK REVIEWS

AMERICAN RADIUM SOCIETY

The recently installed officers of the American Radium Society, for the year 1950–51, are as follows: Leland R. Cowan, M.D., Salt Lake City, Utah, President; Hugh F. Hare, M.D., Boston, Mass., President-Elect; Howard B. Hunt, M.D., Omaha, Nebr., First Vice-President; Franz J. Buschke, M.D., Seattle, Wash., Second Vice-President; John E. Wirth, M.D., U. S. Marine Hospital, Baltimore, Md., Secretary; Grant H. Beckstrand, M.D., Long Beach, Calif., Treasurer. A. W. Arneson, M.D., St. Louis, Mo., is Chairman of the Executive Committee.

LOS ANGELES RADIOLOGICAL SOCIETY

At the meeting of the Los Angeles Radiological Society on Dec. 5, 1950, the following were elected to office for the ensuing year: Moris Horwitz, M.D., President; Joseph Linsman, M.D., Vice-President; Harold P. Tompkins, M.D., 658 S. Westlake Ave., Los Angeles, Secretary; M. M. Haskell, M.D., Treasurer; Wybren Hiemstra, M.D., Member of the Executive Committee.

RADIOLOGICAL SOCIETY OF NEW JERSEY

The Mid-Winter Meeting of the Radiological Society of New Jersey was held at the Winfield-Scott Hotel, Elizabeth, on February 3. The afternoon speaker was Frederic E. Elliott, M.D., Vice-President and Director of Medical Services, United Medical Services, Inc., who took as his subject "Hospital-Radiologist Relationships." Following dinner, Dr. Herbert C. Maier of Lenox Hill Hospital, New York City, spoke on "Tumors of the Chest."

SAN DIEGO RADIOLOGICAL SOCIETY

The newly elected officers of the San Diego Radiological Society are: President, Dr. Ely Whitehead; Vice-President, Dr. John Eneboe; Secretary-Treasurer, Dr. R. F. Niehaus, 1831 Fourth Ave., San Diego 1. The meeting data of the Society has been changed to the first Tuesday of each month, for dinner.

ARGENTINA CONGRESS OF RADIOLOGY

The Third Argentina Congress of Radiology and First Pan-American Congress of Radiology will be held in Córdoba, Argentina, May 3–6, 1951. This meeting is organized by the Argentina Radiological Association.

Official themes will include the following: abdominal tumors; mediastinal tumors; cancer of the lip; radiophysiopathology of the bronchial system; cancer of the eyelid; radiology of renal tuberculosis; and cancer of the larynx. The Barcia Conferences, under the direction of Dr. Carlos Osorio López, will be on the topic: "Present Status of the Early Diagnosis of Cancer of the Lung."

Dr. Lidio G. Mosca is Honorary President of the Congress, Dr. Juan I. Zorrilla, President. Other officers and members of the Executive Committee include Dr. Raúl Mayer, First Vice-President; Dr. Victor Añaños, Second Vice-President; Dr. S. DiRienzo, Secretary; Dr. Antonio Boher, Treasurer; Drs. Juan A. Orfila, Manuel Quintana, Roberto Roher, Horacio Trejo, Néstor R. Montángero, Carlos A. Sánchez de Bustamente, and Fernando Torres.

SOCIEDAD RADIOLÓGICA PANAMEÑA

The Radiological Society of Panama has recently undertaken the publication of a journal, *Radiologia*, to appear quarterly and to carry a comprehensive account of radiological activities in Spanish-speaking countries, as well as translations or reprints of papers published elsewhere. The editor is Dr. L. Arrieta Sanchez.

At a recent meeting of the Society the entire Executive Committee was re-elected to serve for the period 1951–52.

POSTGRADUATE COURSE ROENTGENOGRAPHIC INTERPRETATION OF DISEASES OF THE BONES AND JOINTS

A postgraduate course in the roentgenographic interpretation of diseases of the bones and joints will be presented at the Hospital for Joint Diseases, New York City, in affiliation with the College of Physicians and Surgeons, Columbia University, from March 7 through May 23, 1950. It will comprise a series of lectures with lantern slide demonstrations covering acute and chronic diseases of bones and joints, including granulomata, neurotrophic lesions, neoplasms, and the manifestations of nutritional and metabolic bone changes in children and adults.

Further information may be obtained from Miss Amelia Mater, Hospital for Joint Diseases, 1919 Madison Ave., New York, N. Y.

AMERICAN CONGRESS OF PHYSICAL MEDICINE

The American Congress of Physical Medicine will hold its twenty-ninth annual scientific and clinical session Sept. 4–8, 1951, at the Shirley-Savoy Hotel, Denver, Colo. All sessions will be open to physicians and other professional personnel. Full information may be obtained by writing to the American

Congress of Physical Medicine, 30 North Michigan Ave., Chicago 2, Ill.

Books Received

Books received are acknowledged under this heading, and such notice may be regarded as recognition of the courtesy of the sender. Reviews will be published in the interest of our readers and as space permits.

ORAL AND FACIAL CANCER. By BERNARD G. SARNAT, M.D., F.A.C.S., Professor and Head of the Department of Oral and Maxillofacial Surgery, College of Dentistry, and Clinical Assistant Professor of Surgery, College of Medicine and Research and Educational Hospital, University of Illinois, Chicago; Diplomate of the American Board of Plastic Surgery, and ISAAC SCHOUR, D.D.S., Ph.D., Sc.D., Co-ordinator of Cancer Instruction, Professor and Head of the Department of Histology and Associate Dean in Charge of Postgraduate Studies, University of Illinois College of Dentistry, Chicago. With a Foreword by ANDREW C. IVY, Ph.D., M.D., D. Sc., Vice-President in Charge of Chicago Professional Colleges, University of Illinois; Executive Director of the National Advisory Cancer Council. A volume of 300 pages, with 118 illustrations. Published by the Year Book Publishers, Inc., Chicago, Ill., 1950. Price $6.00.

SELECTED PAPERS FROM THE ROYAL CANCER HOSPITAL (FREE) AND THE CHESTER BEATTY RESEARCH INSTITUTE. Vol. V. Published by order of the Board of Governors of the Royal Cancer Hospital, London. A volume of 484 pages, with numerous illustrations, comprised of articles published by members of the hospital staff during the years 1945–47. Price 16s.

LES VOLVULUS AIGUS DU COLON DROIT. By ALBERT COURTY, Chargé des fonctions d'agrégé á la Faculté de Médecine de Montpellier; Chirurgien assistant des Hˆpitaux. A monograph of 104 pages, with 45 illustrations. Published by Masson et Cie, Paris, 1950. Price 350 fr.

CONTRIBUCIÓN AL ESTUDIO DEL RABDOMIOBLASTOMA. "SARCOMA ARRACIMADO" DE LA VAGINA EN LAS NIÑAS. TRES CASOS. Tesis Doctorales de Medicina y Cirugía. By DR. RAMIRO ALVAREZ ZAMORA, Anátomo-patólogo de la Clínica de Terapéutica Física e Instituto de Cancerología, Ayudante de la I Clínica de Obstetricia y Ginecología, Ayudante de la II Clínica de Obstetricia y Ginecología. A monograph of 82 pages, with 18 illustrations. Published by Librería de Ciencias Médicas, Barcelona, Spain, 1950.

HIRNDURCHBLUTUNGSSTÖRUNGEN. IHRE KLINIK UND ARTERIOGRAPHISCHE DIAGNOSE. By A. BROBEIL, Dozent an der Universitäts-Nervenklinik Marburg-Lahn. A volume of 264 pages, with 84 illustrations. Published by Georg Thieme, Stuttgart, 1950. Agents for U.S.A., Grune & Stratton, Inc., New York.

Book Reviews

RADIATION THERAPY IN THE MANAGEMENT OF CANCER OF THE UTERINE CERVIX. By SIMEON T. CANTRIL, M.D., Director, Tumor Institute of the Swedish Hospital, Seattle, Wash. Publication No. 55, American Lecture Series, edited by Milton Friedman, M.D. A volume of 196 pages, with 25 figures and 30 tables. Published by Charles C Thomas, Springfield, Ill., 1950. Price $5.00.

This short tome is an able résumé of prevalent methods of irradiation of carcinoma of the cervix, by the Director of the Swedish Hospital Tumor Institute, Seattle. Cervical and parametrial needling technics are not considered nor is there any discussion of experimental or theoretical interstitial irradiation, omissions which go unexplained. Clinical and pathologic data are well presented. The writer is critical, but fair, and writes in a style which makes for easy reading. There is little new in this monograph but the reader—especially the less experienced—may find clarification of many ideas about cervical cancer and its therapy.

The illustrations are good and there are many useful tables and graphs.

UNFALLCHIRURGIE IM RÖNTGENBILDE. By DR. WALTHER EHALT, Leiter des Unfallkrankenhauses in Graz, with foreword by PROFESSOR DR. LORENZ BÖHLER, Wien, Leiter des Unfallkrankenhauses in Wien. A volume of 620 pages, with 1,379 illustrations and 14 tables. Verlag Wilhelm Maudrich, Wien, 1950.

This imposing book on the roentgenography of traumatic surgery is dedicated to Professor Lorenz Böhler in honor of his sixty-fifth birthday. The outstanding feature of the work lies in its wealth of illustrations—nearly 1,400 half-tone cuts. These are printed on excellent paper and are for the most part very well done. The roentgenograms are well chosen and, while the American reader will be mildly displeased that they are not printed in the "negative" so as to be directly comparable with the film as viewed in the clinic, it is unquestionable that more detail has been preserved by printing in the "positive." Some of the poorer views may be accounted for by the fact that they are copies of bedside roentgenograms. The illustrations are profusely captioned, so that one gets almost as much information from them alone as from the text.

In Memoriam

MARY INGLEHART

1878—1950

Miss Mary Inglehart, who for many years was associated with RADIOLOGY as Editorial Assistant, died in New Orleans, on Dec. 2, 1950, at the age of seventy-two years. She was born in Plainsville, Ohio, on Jan. 20, 1878.

Miss Inglehart devoted the greater part of her life to editing material for medical journals. Before becoming associated with RADIOLOGY, she had worked as a member of the editorial staff of *Surgery, Gynecology and Obstetrics*, and other prominent medical journals.

When Dr. Max Hubeny, of Chicago, became Editor of RADIOLOGY, he had the good fortune to obtain the services of Miss Inglehart as his assistant, and she remained with him until the journal was removed, in 1931, to New Orleans, when she became assistant to the new editor, Dr. Leon J. Menville. This association was pleasant and profitable both to the Editor and to RADIOLOGY, and continued until 1941, when the Journal was removed to Detroit under the editorship of Dr. Howard P. Doub.

It was during the "depression period" of RADIOLOGY, when the outlook was black, that Miss Inglehart showed her true valor. Unsubdued in spirit and undepressed in mind, she worked hard and long to carry the journal on to a successful issue. Her arduous duties were performed efficiently and cheerfully. When she tackled an editorial job she tackled it vigorously, fired with enthusiasm for rendering adequate service to the Society and the journal. Her painstaking care extended even to the more routine work of proofreading. So seldom did she overlook an error that the other members of the Editorial Staff considered it a magnificent achievement to find one of Miss Inglehart's mistakes. Her splendid work for RADIOLOGY was reflected in a fine journal. She was easy to work with, friendly, amiable, refined—a cultured lady.

LEON J. MENVILLE, M.D.

RADIOLOGICAL SOCIETIES: SECRETARIES AND MEETING DATES

Editor's Note: Secretaries of state and local radiological societies are requested to co-operate in keeping this section up-to-date by notifying the editor promptly of changes in officers and meeting dates.

RADIOLOGICAL SOCIETY OF NORTH AMERICA. *Secretary-Treasurer*, Donald S. Childs, M.D., 713 E. Genesee St., Syracuse 2, N. Y.

AMERICAN RADIUM SOCIETY. *Secretary*, John E. Wirth, M.D., U. S. Marine Hospital, Baltimore, Md.

AMERICAN ROENTGEN RAY SOCIETY. *Secretary*, Barton R. Young, M.D., Germantown Hospital, Philadelphia 44, Penna.

AMERICAN COLLEGE OF RADIOLOGY. *Secretary*, William C. Stronach, 20 N. Wacker Dr., Chicago 6, Ill.

SECTION ON RADIOLOGY, A. M. A. *Secretary*, Paul C. Hodges, M.D., 950 East 59th St., Chicago 37.

Alabama

ALABAMA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, W. D. Anderson, M.D., 420 10th St., Tuscaloosa.

Arizona

ARIZONA ASSOCIATION OF PATHOLOGISTS AND RADIOLOGISTS. *Secretary*, R. Lee Foster, M.D., 507 Professional Bldg., Phoenix.

Arkansas

ARKANSAS RADIOLOGICAL SOCIETY. *Secretary*, Fred Hames, M.D., Pine Bluff. Meets every three months and at meeting of State Medical Society.

California

CALIFORNIA MEDICAL ASSOCIATION, SECTION ON RADIOLOGY. *Secretary*, Sydney F. Thomas, M.D., Palo Alto Clinic, Palo Alto.

EAST BAY ROENTGEN SOCIETY. *Secretary*, Dan Tucker, M.D., 434 30th St., Oakland 9. Meets monthly, first Thursday, at Peralta Hospital.

LOS ANGELES RADIOLOGICAL SOCIETY. *Secretary*, Harold P. Tompkins, M.D., 658 South Westlake Ave. Meets monthly, second Wednesday, County Society Bldg.

NORTHERN CALIFORNIA RADIOLOGICAL CLUB. *Secretary*, Clifford W. Wauters, 701 High St., Auburn. Meets at dinner last Monday of September, November, January, March, and May.

PACIFIC ROENTGEN SOCIETY. *Secretary*, L. Henry Garland, M.D., 450 Sutter St., San Francisco 8. Meets annually with State Medical Association.

SAN DIEGO ROENTGEN SOCIETY. *Secretary*, R. F. Niehaus, M.D., 1831 Fourth Ave., San Diego. Meets first Wednesday of each month.

X-RAY STUDY CLUB OF SAN FRANCISCO. *Secretary*, Merrell A. Sisson, M.D., 450 Sutter St., San Francisco 8. Meets third Thursday at 7:45, January to June at Stanford University Hospital, July to December at San Francisco Hospital.

Colorado

COLORADO RADIOLOGICAL SOCIETY. *Secretary*, Paul E. RePass, M.D., 306 Republic Bldg., Denver 2. Meets monthly, third Friday, at University of Colorado Medical Center or Denver Athletic Club.

Connecticut

CONNECTICUT STATE MEDICAL SOCIETY, SECTION ON RADIOLOGY. *Secretary*, Fred Zaff, M.D., 135 Whitney Ave., New Haven. Meetings bimonthly second Wednesday.

CONNECTICUT VALLEY RADIOLOGICAL SOCIETY. *Secretary*, Ellwood W. Godfrey, M.D., 1676 Boulevard, W. Hartford. Meets second Friday of October and April.

District of Columbia

RADIOLOGICAL SECTION, DISTRICT OF COLUMBIA MEDICAL SOCIETY. *Secretary*, Karl C. Corley, M.D., 1835 Eye St., N.W., Washington 6. Meets third Thursday, January, March, May, and October, at 8:00 P.M., in Medical Society Auditorium.

Florida

FLORIDA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Thos. H. Lipscomb, M.D., 30 West Beaver St., Jacksonville, 2. Meets in April and in November.

GREATER MIAMI RADIOLOGICAL SOCIETY. *Secretary*, David Kirsh, M.D., 712 duPont Bldg., Miami 32. Meets monthly, last Wednesday, 8:00 P.M.

Georgia

ATLANTA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Ted F. Leigh, M.D., Emory University Hospital. Meets second Friday, September to May.

GEORGIA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Robert C. Pendergrass, M.D., Americus. Meets in November and at the annual meeting of State Medical Association.

Illinois

CHICAGO ROENTGEN SOCIETY. *Secretary*, Benjamin D. Braun, M.D., 6 N. Michigan Ave., Chicago 11. Meets at the University Club, second Thursday of October, November, January, February, March, and April at 8:00 P.M.

ILLINOIS RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, William DeHollander, M.D., St. Johns' Hospital, Springfield. Meetings quarterly as announced.

ILLINOIS STATE MEDICAL SOCIETY, SECTION ON RADIOLOGY. *Secretary*, Willard C. Smullen, M.D., St. Mary's Hospital, Decatur.

Indiana

INDIANA ROENTGEN SOCIETY. *Secretary-Treasurer*, William M. Loehr, M.D., 712 Hume-Mansur Bldg., Indianapolis 4. Annual meeting in May.

Iowa

IOWA X-RAY CLUB. *Secretary*, Arthur W. Erskine, M.D., 326 Higley Building, Cedar Rapids. Meets during annual session of State Medical Society.

Kansas

KANSAS RADIOLOGICAL SOCIETY. *Secretary*, Anthony F. Rossitto, M.D., Wichita Hospital, Wichita. Meets annually with State Medical Society.

Kentucky

KENTUCKY RADIOLOGICAL SOCIETY, *Secretary*, Everett L. Pirkey, M.D., Louisville General Hospital. Meets monthly, second Friday, at Seelbach Hotel.

Louisiana

LOUISIANA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Johnson R. Anderson, M.D., No. Louisiana Sanitarium, Shreveport. Meets with State Medical Society.

ORLEANS PARISH RADIOLOGICAL SOCIETY. *Secretary*, Joseph V. Schlosser, M.D., Charity Hospital of Louisiana, New Orleans 13. Meets first Tuesday of each month.

SHREVEPORT RADIOLOGICAL CLUB, *Secretary*, Oscar O. Jones, M.D., 2622 Greenwood Road. Meets monthly September to May, third Wednesday.

Maine

MAINE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Clark F. Miller, M.D., Central Maine General Hospital, Lewiston.

Maryland

BALTIMORE CITY MEDICAL SOCIETY, RADIOLOGICAL SECTION. *Secretary*, J. Howard Franz, M.D., 1127 St. Paul St., Baltimore 2.

Michigan

DETROIT X-RAY AND RADIUM SOCIETY. *Secretary*, James C. Cook, M.D., Harper Hospital, Detroit 1. Meetings first Thursday, October to May, at Wayne County Medical Society club rooms.

MICHIGAN ASSOCIATION OF ROENTGENOLOGISTS. *Secretary-Treasurer*, R. B. MacDuff, M.D., 220 Genesee Bank Building, Flint 3.

Minnesota

MINNESOTA RADIOLOGICAL SOCIETY. *Secretary*, Leo A. Nash, M.D., 572 Lowry Medical Arts Bldg., St. Paul 2. Meets in Spring and Fall.

Missouri

RADIOLOGICAL SOCIETY OF GREATER KANSAS CITY. *Secretary*, Wm. M. Kitchen, M.D., 1010 Rialto Building, Kansas City 6, Mo. Meetings last Friday of each month.

ST. LOUIS SOCIETY OF RADIOLOGISTS. *Secretary*, H. R. Senturia, M.D., Pasteur Medical Bldg. Meets on fourth Wednesday, October to May.

Nebraska

NEBRASKA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Russell W. Blanchard, M.D., 1216 Medical Arts Bldg., Omaha. Meets fourth Thursday of each month at 6 P.M. in Omaha or Lincoln.

New England

NEW ENGLAND ROENTGEN RAY SOCIETY. *Secretary*, L. L. Robbins, M.D., Massachusetts General Hospital, Boston 14. Meets monthly on third Friday at the Harvard Club.

New Hampshire

NEW HAMPSHIRE ROENTGEN SOCIETY. *Secretary*, Albert C. Johnston, M.D., Elliot Community Hospital, Keene. Meetings quarterly in Concord.

New Jersey

RADIOLOGICAL SOCIETY OF NEW JERSEY. *Secretary*, Peter J. Gianquinto, M.D., 685 High St., Newark 2. Meets at Atlantic City at time of State Medical Society and midwinter in Elizabeth.

New York

ASSOCIATED RADIOLOGISTS OF NEW YORK, INC. *Secretary*, William J. Francis, M.D., East Rockaway.

BROOKLYN ROENTGEN RAY SOCIETY. *Secretary*, J. Daversa, M.D., 603 Fourth Ave., Brooklyn. Meets fourth Tuesday, October to April.

BUFFALO RADIOLOGICAL SOCIETY. *Secretary-Treasurer*. Mario C. Gian, M.D., 610 Niagara St., Buffalo 1. Meetings second Monday, October to May.

CENTRAL NEW YORK ROENTGEN SOCIETY. *Secretary*, Dwight V. Needham, M.D., 608 E. Genesee St., Syracuse 10. Meetings January, May, October.

KINGS COUNTY RADIOLOGICAL SOCIETY. *Secretary*, Marcus Wiener, M.D., 1430 48th St., Brooklyn 19. Meetings fourth Thursday evening, October to May, at 8:45 P.M., in Kings County Medical Bldg.

NEW YORK ROENTGEN SOCIETY. *Secretary*, John L. Olpp, M.D., 49 Ivy Lane, Tenafly, N. J.

QUEENS ROENTGEN RAY SOCIETY. *Secretary*, Jacob E. Goldstein, M.D., 88-29 163rd St., Jamaica 3. Meets fourth Monday of each month.

ROCHESTER ROENTGEN-RAY SOCIETY. *Secretary-Treasurer*, A. Vaughn Winchell, M.D., 40 Meigs St. Meets at Strong Memorial Hospital, last Monday of each month, September through May.

North Carolina

RADIOLOGICAL SOCIETY OF NORTH CAROLINA. *Secretary*, James E. Hemphill, M.D., Professional Bldg., Charlotte 2. Meets in May and October.

North Dakota

NORTH DAKOTA RADIOLOGICAL SOCIETY. *Secretary*, Charles Heilman, M.D., 807 Broadway, Fargo.

Ohio

OHIO STATE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Edward C. Elsey, M.D., 927 Carew Tower, Cincinnati 2. Meets with State Medical Association.

CENTRAL OHIO RADIOLOGICAL SOCIETY. *Secretary*, Frank A. Riebel, M.D., 15 W. Goodale St., Columbus. Meets second Thursday, October, December, February, April, and June, 6:30 P.M., Columbus Athletic Club, Columbus.

CLEVELAND RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, John R. Hannan, M.D., 10515 Carnegie Ave., Cleveland 6. Meetings at 6:45 P.M. on fourth Monday, October to April, inclusive.

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Oklahoma

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Oregon

OREGON RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, C. Todd Jessell, M.D., 224 Medical-Dental Bldg., Portland 5. Meets monthly, on the second Wednesday, at 8:00 P.M., in the library of the University of Oregon Medical School.

Pacific Northwest

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PITTSBURGH ROENTGEN SOCIETY. *Secretary-Treasurer*, Edwin J. Euphrat, M.D., 3500 Fifth Ave., Pittsburgh 13. Meets monthly, second Wednesday, at 6:30 P.M., October to May, at Webster Hall.

Rocky Mountain States

ROCKY MOUNTAIN RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Maurice D. Frazer, M.D., Lincoln Clinic, Lincoln, Nebr. Next annual meeting, Aug. 9–11, 1951, Denver, Colo.

South Carolina

SOUTH CAROLINA X-RAY SOCIETY. *Secretary-Treasurer*, S. H. Fisher, M.D., 107 E. North St., Greenville. Meets with State Medical Association in May.

South Dakota

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Tennessee

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TENNESSEE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, J. Marsh Frère, M.D., 707 Walnut St., Chattanooga. Meets annually with State Medical Society in April.

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Virginia

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WASHINGTON STATE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, R. C. Kiltz, M.D., 705 Medical-Dental Bldg., Everett. Meetings fourth Monday, October through May, at College Club, Seattle.

Wisconsin

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UNIVERSITY OF WISCONSIN RADIOLOGICAL CONFERENCE. Meets first and third Thursdays 4 P.M., September to May, Service Memorial Institute, Madison 6.

WISCONSIN RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Irving I. Cowan, M.D., 425 East Wisconsin Ave., Milwaukee 2.

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CUBA

SOCIEDAD DE RADIOLOGÍA Y FISIOTERAPÍA DE CUBA. Offices in Hospital Mercedes, Havana. Meets monthly.

MEXICO

SOCIEDAD MEXICANA DE RADIOLOGÍA Y FISIOTERAPÍA. *General Secretary*, Dr. Dionisio Pérez Cosío, Marsella 11, México, D. F. Meetings first Monday of each month.

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SOCIEDAD RADIOLÓGICA PANAMEÑA. *Secretary-Editor* Luis Arrieta Sánchez, M.D., Apartado No. 86 Panama, R. de P.

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ROENTGEN DIAGNOSIS

THE HEAD AND NECK

On a New Encephalographic Method for the Separate Demonstration of the Cerebral Ventricles and the Enlarged Peripheral Fissure Spaces. H. Becker and F. Radtke. Fortschr. a. d. Geb. d. Röntgenstrahlen **72:** 160–173, December 1949. (In German)

The authors' method of encephalography is based on serialographic observations regarding the mode of air passage and its distribution, complemented by observations on pain and concomitant symptoms.

In lumbar air injection the air first accumulates in the cisterna cerebellomedullaris, the "first distribution point." From here it may pass on by two routes. The first route leads through the foramen of Magendie into the fourth ventricle and from there, *via* the aqueduct, into the third and lateral ventricles. This route is narrow and the passage through it can be influenced only slightly by certain manipulations. The second route is wider but, in forward flexion of the head, can be used only by "overflow." As the cisterna cerebellomedullaris has no opening superiorly, the adit to the ventrally located cisterna pontis in forward flexion of the head lies below the adit to the foramen of Magendie. After entrance into the cisterna pontis the air passes through a wide subarachnoidal communication immediately into the cisterna basalis, the "second distribution point." Further passage occurs principally through the cisterna lateralis (fossa Sylvii), less through the cisterna ambiens and interhemispherica, and thence to the subarachnoidal spaces. On account of the narrowness of the entrance to the ventricular system, the filling by means of the ordinary lumbar injection method supplies the cisterna cerebellomedullaris with too much air in too short a time. The consequence is that not all the air can pass to the ventricles but is forced to overflow into the cisterna pontis and basalis. In addition, the removal of large amounts of cerebrospinal fluid produces a suction effect in the subarachnoidal system which further favors the air flow to the periphery.

Serial radiography has shown that the filling of the ventricles proper causes no complaints. The so-called "vegetative complaint complex" (nausea, vomiting, perspiration, bradycardia, and collapse) is due to the presence of air in the cisterna basalis. Headache is the definite result of air passage into the cisterna lateralis, interhemispherica, and ambiens, and into the subarachnoidal system. This headache corresponds in location fairly accurately to the site of air accumulation: temporal headache points to filling of the cisterna lateralis, frontal headache to the cisterna interhemispherica, occipital headache to the cisterna ambiens (except in initial stages, where it may also be due to overfilling of the cisterna cerebellomedullaris); headache over the entire cranium points to filling of the entire subarachnoidal system over the convexity of the skull.

In pursuance of the principles demonstrated by these observations the authors perfected their method by direction of the air filling and close attention to symptoms. By anterior flexion of the head, slow injection of small amounts of air combined with removal of only small amounts of cerebrospinal fluid (the total only approaching about two thirds of the ventricular capacity), and guidance by the appearance of symptoms, fillings of the ventricles only, corresponding in radiographic detail to surgical ventriculograms, could be achieved. If the premises are reversed—*i.e.* posterior flexion of the head and use of large amounts of air combined with large fluid withdrawals in relatively short periods—pure subarachnoidal fillings can be obtained. Separate filling of the cisterna basalis and the other cisternae is also possible by regulation of the amount of air injected and by attention to the patient's symptoms. For the visualization of the ventricles only, about 30 to 40 c.c. of air are generally sufficient.

It is evident that for the full utilization of this method the intelligent co-operation of the patient is indispensable. In delirious, non-cooperative or unconscious patients, an attempt with the minimal amount of air (20 to 30 c.c.) may be made or one may be guided by the above mentioned "vegetative dysregulations" (vomiting, bradycardia, etc.), but a certain air filling of the peripheral spaces is the rule in the latter cases.

Twenty roentgenograms.

ERNST A. SCHMIDT, M.D.
Denver, Colo.

Cerebral Angiography. R. W. Byrne. Wisconsin M. J. **49:** 209–211, March 1950.

This is a brief general discussion of cerebral angiography, accompanied by schematic drawings to illustrate the normal findings and various pathological conditions, as solitary congenital aneurysm, angioma, subdural hematoma, and tumors. Angiography is superior to air studies in cases of space-occupying lesions of the cerebral hemispheres when it is known which side is involved, and in vascular lesions of the brain. Pneumography is to be preferred in cases of increased intracranial pressure without definite localizing signs and in tumors of the ventricular system, midbrain, and basal ganglia.

Eight drawings.

S. F. THOMAS, M.D.
Palo Alto, Calif.

Technic of Percutaneous Cerebral Angiography. Aloys Werner and Hans Richter. Schweiz. med. Wchnschr. **80:** 256–258, March 11, 1950. (In French)

The authors note three disadvantages of percutaneous as contrasted with open cerebral angiography: the introduction of the needle is not very easy, extravasation of thorotrast leads to uncomfortable or even dangerous sequelae, and the resulting films are not quite so brilliant. With the use of an aqueous iodide solution (the essayists use Nosydrast) the second objection is circumvented, and the other objections are not insurmountable. With meticulous technic and the use of a Lysholm head apparatus, it was possible to obtain routinely good studies. The usual views recommended are lateral stereoscopic, anteroposterior stereoscopic, and occasionally oblique views.

Four photographs, 1 drawing.

LEWIS G. JACOBS, M.D.
Oakland, Calif.

Influence of the Autonomic Nervous System on the Cerebral Blood Supply. A. de Sousa Pereira. Arch. Surg. **60:** 456–464, March 1950.

The author reports 5 cases of cerebral thrombosis and ischemia, with both motor loss and psychic changes, particularly depression and increased emotional reaction. In each, arteriographic study of the involved

side of the brain was done before and after cervical sympathectomy. The preoperative studies showed pronounced vasospasm of the cerebral arteries in all, which was found to be markedly less following the operation. A sixth patient, with a bullet wound resulting in hemiplegia and changes similar to those in the other cases, also experienced marked relief of vasospasm following the operation. In all six patients the brain circulation was improved and the motor and psychic disabilities were favorably affected.

Twelve roentgenograms. LEWIS G. JACOBS, M. D.
Oakland, Calif.

Sialography. F. Johnson Putney and Myron J. Shapiro. Arch. Otolaryng. **51:** 526–534, April 1950.

Sialography is indicated (1) to demonstrate the relationship of the normal salivary ducts and glands to adjacent structures; (2) to demonstrate salivary fistulas; (3) to demonstrate calculi, foreign bodies, strictures and diverticula of the ducts; (4) to demonstrate chronic recurrent parotitis; (5) to investigate possible involvement of the gland by disease of adjacent structures; (6) to determine whether a tumor is encapsulated, infiltrating, or extrinsic to the gland; (7) to aid in planning an operative procedure by outlining the depth of a gland tumor; (8) to investigate the structure and function of the gland in cases of dry mouth.

The author inserts a cannula 1 to 1.5 cm. into the duct and injects 0.5 c.c. of lipiodol, after which films are taken in the anteroposterior and lateral projections. These demonstrate the duct system. An additional 1 c.c. is injected and further roentgenograms are obtained to show the parenchyma of the gland.

An obstructed duct is dilated in its central and terminal portions due to narrowing near its orifice.

Extrinsic tumors in the vicinity of the gland cause a defect in the glandular shadow, frequently associated with inability to visualize, or to visualize completely, the ducts in the area.

In the presence of a benign tumor of a salivary gland, a filling defect is outlined by displaced ducts and changes in the parenchymal shadow. Sialectasis may occur beyond the tumor.

Malignant tumors are difficult to differentiate from benign tumors. They may show evidence of infiltration, which is demonstrated by (1) irregular defects in the gland parenchyma, (2) distortion of the duct alignment, (3) incomplete filling and irregularity of the ducts, (4) irregular puddling in the tumor area, (5) and complete filling distal to the tumor unless the main duct is interfered with by the tumor.

Sialograms demonstrate the location of salivary calculi and salivary fistulas readily.

Nine roentgenograms.

HOWARD L. STEINBACH, M.D.
University of California

THE CHEST

Roentgen Examination of the Chest. Its Limitations in the Diagnosis of Disease. Leo G. Rigler. J. A. M. A. **142:** 773–777, March 18, 1950.

Reliance on the roentgen examination of the chest for the detection of disease may not be as completely justified as many believe. The clinical significance of abnormal findings can usually be determined by appropriate studies, but the apparently normal radiograph may produce a false sense of security. The time relationships between the onset of symptoms or signs of disease and the appearance of roentgen changes is of great significance in the final evaluation.

In pulmonary edema, clinical and experimental studies have shown that when the fluid collects in the alveoli, roentgen evidence may be present before symptoms appear or within an hour or two after the onset of dyspnea, and often as long as twelve hours before physical changes are noted. An exception is to be found in interstitial edema, in which roentgen signs may be very slight and difficult to diagnose even though dyspnea is severe.

Interstitial lesions such as occur in atypical or virus pneumonia are apparent in the radiograph only at a late stage. Twenty-four to forty-eight hours must usually elapse after onset of symptoms before roentgen evidence of the disease is obvious. Physical signs may not appear until much later. Conversely, in lobar pneumonia, roentgen changes may be apparent within one to two hours after onset of symptoms and almost invariably are present within eight to twelve hours. Physical findings at these periods are usually indefinite. A normal radiograph, therefore, is not of great significance in the first forty-eight hours after symptoms of atypical pneumonia but is of great significance twelve hours after beginning symptoms of lobar pneumonia and in the latter should lead to further investigation of cause of symptoms.

In acute pleurisy without effusion, roentgen signs are often indefinite, while symptoms may be diagnostic. Small amounts of pleural effusion may be difficult or impossible to detect without special roentgen studies, including lateral decubitus and fluoroscopic examinations.

Pulmonary tuberculosis may be detected roentgenographically long before symptoms or signs develop. There is a latent period, however, of at least eight weeks, and more likely ten weeks, between exposure to the disease and development of roentgen signs. During this time, a normal radiograph may be definitely misleading. Rarely roentgen changes may be lacking in cases showing clinical and laboratory evidence of the disease. If oblique, lateral, and lordotic views were made in such instances, errors would be reduced. Miliary tuberculosis presents a different problem, with the symptoms preceding the roentgen evidence by periods of one week to as much as seven weeks or more.

Pulmonary metastases are usually evident long before symptoms or signs appear. Lesions as small as 3 mm. in diameter may be detected and those of 8 mm. or more should not be missed with adequate study. Miliary metastases may be invisible when insufficient in number or of small size.

In peripheral primary carcinoma of the lung, roentgen evidence usually precedes symptoms and signs by a considerable period. In the more common carcinomas about the hilus, signs and symptoms may be present with apparently normal roentgen studies in many cases. The demonstration of obstructive emphysema by expiration as well as inspiration films may point to the lesion. Careful study of all root shadows, linear areas of atelectasis, and slight enlargement of part of one hilus, and the use of auxiliary procedures such as body section radiography, fluoroscopy, bronchoscopy, cell studies, and others, are indicated whenever symptoms and/or signs are definite and preliminary roentgen studies are unproductive. BERNARD S. KALAYJIAN, M.D.
Detroit, Mich.

Directed Bronchography with Water-Soluble Contrast Substance. Heinz Vieten. Fortschr. a. d. Geb. d. Röntgenstrahlen **72:** 270–281, January 1950. (In German)

Thoracic surgery has made such rapid strides during the past few years that bronchography has become increasingly important as a guide to the surgeon in the operative procedure.

The author routinely gives 0.1 gm. luminal the evening before and on the morning of examination. Fifteen to thirty minutes before the examination the patient receives 0.015 gm. dicodid and 0.25 to 0.5 mg. of atropine (hypodermically). Two per cent pontocaine with adrenalin is used for local anesthetization of the mucosa of the pharynx and bronchial tree.

A semiflexible gum catheter may be employed, with a metal olive fixed on the end. This may be inserted to the bifurcation and directed into the proper bronchus by the rather ingenious method of an inlying silk thread which on traction causes the point of the catheter to bend. A Metras catheter, which may also be used, is somewhat stiffer and can be bent in various directions previous to insertion. It is then directed through the larynx by means of a well oiled guide, the end being bent in advance to the particular angle desired. For examining the lower lobe, the author uses a slight outward bend to the catheter, for the middle lobe, a considerably greater bend, and for the upper lobe, an outer and somewhat posterior direction of the catheter tip. In this manner he can succeed in demonstrating the bronchus in a single lobe or segment of the lung.

It was found that umbradil preparations were unsatisfactory, while joduron-B, which had been used in Switzerland, was difficult to obtain. The author therefore used perabrodil, 50 per cent, increasing the concentration with sodium cellulose glycolate, preferring a moderately viscid type of mixture. This gave an excellent contrast medium, was expelled or absorbed from the lungs in three hours, and excreted through kidneys and bladder. No harmful effects were noted.

The author sums up the disadvantages of lipiodol, which he considers contraindicated in severe heart infections, extreme old age, kidney and lung conditions, including fibrotic changes and emphysema. It does not mix well, forms globules, and does not pass well into the finer divisions of the bronchi. It is difficult to expel, remaining often for months or years, and is believed in some cases to cause a measure of damage to the lung parenchyma; it has been known to be contributory to pneumonitis and atelectasis, and has been thought occasionally to light up a tuberculous focus. It definitely interferes with later studies by remaining in the lung structure. It is believed that, with a water-soluble material, all of these disadvantages will be eliminated.

Thirteen illustrations. E. W. SPACKMAN, M.D.
Fort Worth, Texas

Iodized Oil Bronchography as an Injurious Diagnostic Procedure. F. K. Fischer. Schweiz. med. Wchnschr. **80:** 273–278, March 18, 1950. (In German)

With the present widespread use of iodized oil as a contrast medium, it is sometimes forgotten that it can be a harmful agent. A case is reported to illustrate this point. Bronchography of the right lung was done, demonstrating a minimal bronchiectasis. Five months later a chronic infiltration developed in the right middle lobe and pneumonectomy was performed, on a suspicion of tumor. The pathological study showed a chronic lipoid pneumonia. The patient died postoperatively.

Seven roentgenograms; 1 photograph; 3 photomicrographs. LEWIS G. JACOBS, M.D.
Oakland, Calif.

Angiocardiopneumography. Lopo de Carvalho. Dis. of Chest **17:** 312–334, March 1950.

Carvalho reviews the historical aspects of angiopneumography since his first successful attempt in 1931 and the subsequent application of this method to angiocardiography by Robb and Steinberg.

At the present time the author prefers using the external jugular vein for injection to any of the arm veins. He describes an octagon-shaped drum for holding cassettes, placed beneath the examining table, where it is rotated for making 6 to 8 exposures during the course of a single injection. By angiopneumographic studies the author established the vascular elements of the hilar shadows and reported his findings as early as 1937. In tuberculosis, the pulmonary circulation is either decreased or absent, while in lung abscess the arterial vascularity is increased. This is an aid in differential diagnosis. In pneumothorax cases, the collapsed lung shows decreased circulation.

Angiopneumography is used also to determine circulation time in the lungs, with the aid of a single-slit kymographic grid. The rate of speed of the film being known, the circulation time can be calculated by measuring the distance between the bands of contrast substance. If the slit is so placed that it crosses the superior vena cava and pulmonary artery, the time factor can be measured between these two structures, and similarly with other structures. The author also has used the single-slit kymographic angiopneumographic examination to show the poor vascularity and circulation of the upper lobe as against the lower lobe.

In the discussion of this paper, Dr. Israel Steinberg, who with George Robb devised a practical method of angiocardiography, concurred with Dr. Carvalho, but brought out the fact that the greatest value of angiocardiography is in the differential diagnosis of vascular from non-vascular mediastinal lesions. This type of examination is of great value in congenital heart lesions, for the proper selection of cases for surgery. Early syphilitic aortitis can also be recognized by this method.

Twenty-eight illustrations, including 21 roentgenograms and kymograms. HENRY K. TAYLOR, M.D.
New York, N. Y.

Diagnostic Value of Pulmonary Arteriography in Bronchial Carcinoma. P. G. Keil, C. A. Voelker, and D. J. Schissel. Am. J. M. Sc. **219:** 301–306, March 1950.

In 14 of 15 patients with bronchial carcinoma, pulmonary arteriography with diodrast showed diminished vascularity in all or part of the lung distal to the lesion. In 9 cases the secondary radicles within the tumor were narrowed, distorted, or occluded; in 2 the main pulmonary trunk was displaced and distorted, and in 1 the major part of the right pulmonary artery was obstructed. A normal vascular pattern was found in a single instance with a diffuse lymphangitic spread before development of a hilar mass.

The diminished vascularity associated with pulmonary tumors may be the result of pressure by the tumor, causing arterial occlusion, emphysema from partial

bronchial obstruction, or necrosis of the lung. Other processes in which there may be diminished vascularity are rarely accompanied by a tumor and include senile emphysema, bullous emphysema, and lung abscess.

The arteriographic technic followed by the authors was to inject 50 c.c. of 70 per cent diodrast, after which films in the postero-anterior projection were made at two, four, six and eight seconds, with an increase of 10 kv. over the usual chest technic. The two- and four-second films outline the lesser circulation, while the six- and eight-second films demonstrate the greater circulation.

Six roentgenograms; 1 photograph.

CORNELIUS COLANGELO, M.D.
Chicago, Ill.

Lung Cavitation Due to Tumor. Rudolf Pape. Fortschr. a. d. Geb. d. Röntgenstrahlen **72:** 257–270, January 1950. (In German)

The author quotes from the literature two theories of cavity formation within tumors: (1) stasis of the circulation with local ischemia and resulting centralized necrosis, (2) secondary infection resulting in break-down of the mass. The bronchi become obstructed by necrotic material and thick secretions and bronchostenosis and atelectasis occur. It is believed that frequently a chronic indurative process (infection) is the background for tumor formation.

Irregularity of the cavity wall has previously been regarded as indicative of a malignant process. This, however, has not been found to be characteristic. Thin-walled cavities occurred in the large proportion of the author's cases, and quite frequently where secondary infection had been present. Bronchiectasis, although occasionally arising secondary to an inflammatory process, is more frequently present with carcinoma.

According to the author, points indicating the probability of cavitation within a tumor are: (1) mediastinal shift resulting from bronchostenosis (with atelectasis); (2) elevation of the diaphragm (involvement of phrenic nerve); (3) deformity or involvement of the esophagus; (4) recognizable local or distant metastasis (especially in the ribs or skeleton); (5) central irregularity or coarsely outlined cavity; (6) a small cavity in the dense lobar type of homogeneous shadow; (7) thin cystic type of outline; (8) signs of involvement of pleura or ribs by direct extension.

Evidence against the process being malignant cavitation includes: (1) double-walled cavitation with delicate stripes leading from the cavity to the hilus; (2) sharp convex outline visualized close to or superimposed upon the hilar density; (3) pleural thickening or effusion.

The most difficult cases to evaluate, in the author's experience, have been those in the periphery of the lung with smoothly outlined walls, basilar masses with evidence of probable secondary abscess formation, masses associated with bronchiectasis and with peripheral abscess formation. In such cases it is often impossible to determine whether malignant growth or infection causes the x-ray appearance.

The great importance of correlating the x-ray findings with the clinical and laboratory features of an individual case and the use of special investigative procedures such as tomography, bronchoscopy and bronchography, esophagoscopy, and occasionally diagnostic pneumothorax or response to x-ray therapy are mentioned.

[We are rapidly coming to the conclusion, in this country, that all such lesions except those proved to be on the basis of specific infectious conditions should be explored surgically as early as possible.—E.W.S.]

Fifteen illustrations.

E. W. SPACKMAN, M.D.
Fort Worth, Texas

Cavernous Hemangioma of the Lung. James H. Forsee, Hugh W. Mahon, and L. A. James. Ann. Surg. **131:** 418–423, March 1950.

The authors report the case of a young man who had an infiltrating lesion in the right upper lung field diagnosed as pulmonary tuberculosis. Further studies revealed the typical picture of an arteriovenous fistula in the lung. The patient was cyanotic, with clubbing of the fingers and polycythemia. Films of the chest revealed a "comet"-shaped infiltration in the right upper lung field. Angiocardiography demonstrated an arteriovenous shunt in the right lung with slight dilatation of the pulmonary artery. Lobectomy resulted in dramatic improvement.

The mechanics of the disturbed physiology consists in a shunting of the venous blood from the pulmonary artery to the radicals of the pulmonary vein. This results in failure of oxygenation with variable degrees of cyanosis and polycythemia.

Three roentgenograms; 1 photograph; 2 tables.

ROBERT A. HAYS, M.D.
Cleveland Clinic Foundation

Primary Chondromas of the Lung. Lew A. Hochberg and Morris Pernikoff. Dis. of Chest **17:** 337–346, March 1950.

A chondroma of the lung is a cartilaginous tumor in the substance of which there may be some other connective-tissue elements, chiefly osseous and fibrous tissue; it differs from a hamartoma (Albrecht, 1904), which is a "tumor-like formation in which there is an abnormal arrangement of the normal components."

Chondroma of the lung is a rare tumor, having been found but twice in a series of 4,800 autopsies at the Jewish Hospital, Brooklyn, and an equal number of times in a series of 28,000 autopsies, reviewed by Verga (Pathologica **24:** 1, 1932). The authors add 3 cases to the literature, making a total of 78 reported cases. Of the 3 tumors, 2 were found postmortem. The third was removed surgically from a 37-year-old male, who experienced recurrent hemoptyses following a chest injury. A roentgenogram showed an irregular dense shadow opposite the eighth rib posteriorly on the right.

Almost 80 per cent of the reported pulmonary chondromas have occurred in persons over forty years of age. The right lung is more commonly involved. The tumors are variable in size, the smaller ones being generally attached to a larger bronchus, while the larger ones are usually located in the parenchyma. The shape is round or ovoid and the surface lobulated. The symptoms are dependent upon the size, location, and duration of the tumor and its effects upon the surrounding tissues. In many instances the lesion is asymptomatic.

The roentgenographic examination reveals an oval or round circumscribed mass with a lobulated border, which varies in size and location. The tumor may contain areas of increased density.

One roentgenogram; 1 drawing of the excised chondroma; 1 photomicrograph.

HENRY K. TAYLOR, M.D.
New York, N. Y.

Studies in the Clinical Evaluation of Disability in Anthracosilicosis. Peter A. Theodos, Burgess Gordon, Leonard P. Lang, and Hurley L. Motley. Dis. of Chest **17:** 249–270, March 1950.

The authors studied 375 hard coal miners with various stages of silicosis, from the point of view of respiratory impairment and the degree of disability. The study included history, physical examination, exercise test, numerous laboratory studies, electrocardiography, fluoroscopy and roentgenography of the chest, bronchoscopy and bronchography, and tests of pulmonary function.

The chief cause for work stoppage was dyspnea, which was present in 340 of the 375 cases.

A roentgenographic classification of the cases showed 36 to be normal or borderline, 46 first stage, 64 second stage, and 229 third stage silicosis. Forty-seven of the men had active tuberculosis. The major causes for disability were related to cardiovascular disturbances (69 cases). There were many other significant medical conditions, such as non-specific pulmonary infections (47), arterial hypertension (38), chronic nephritis (38), bronchiectases (14), syphilis (12), generalized arteriosclerosis (11), arthritis (9), and bronchogenic carcinoma (6).

In 186 of the 375 cases, disability was complicated by one or more infectious, metabolic, or degenerative conditions. In 189, silicosis was regarded as producing the main disability on a pulmonary basis.

The degree of pulmonary function impairment was evaluated from physiological tests performed on 150 of the cases and the results were compared with the clinical impression. This revealed dyspnea as the chief cause for disability; it was present for three years or more in 94 of this group (62.4 per cent) before becoming severe enough to cause work stoppage. There was a marked discrepancy between clinical impression and physiological studies. There appeared to be no relationship between the degree of pulmonary impairment, stage of silicosis, and duration of exposure.

An accurate evaluation of disability in anthrosilicosis requires a correlation of signs, symptoms, roentgenologic, and laboratory examinations. Adequate physiological studies of pulmonary function require measurements on ventilation, degree of emphysema, and the respiratory gas exchange at rest and during exercise. In the absence of pulmonary function studies, one must bear in mind that there may be a marked disparity between the complaints and the actual degree of pulmonary dysfunction.

A fair estimate of the degree of pulmonary dysfunction can be obtained by the ordinary clinical methods when the impairment is due to decreased ventilation and increased emphysema, but not when it is due to arterial blood-oxygen unsaturation.

In a discussion of this paper Dr. Saul Solomon stressed the absence of any relationship between the length of exposure to silica and the x-ray findings, and between the x-ray findings and the symptomatology. He emphasized that pulmonary fibrosis, involving the pulmonary capillary bed, and emphysema are the causes for the dyspnea. In a survey that he had made of 700 foundry workers, there were 90 cases of silicosis and not one of tuberculosis.

The article is full of factual information and well worth reading.

Fifteen tables. HENRY K. TAYLOR, M.D.
New York, N. Y.

Etiological Significance of Pulmonary Calcifications at University of Toronto. T. G. Heaton. Canad. M.A.J. **62:** 252–254, March 1950.

In a routine radiological chest survey at the University of Toronto in 1948, 8,144 films were taken, of which 122 showed pulmonary calcifications, an incidence of 1.5 per cent. Of the 122 persons showing calcifications, 63 were tested for sensitivity to tuberculin and histoplasmin. The results were as follows: tuberculin positive and histoplasmin negative, 20; both tests positive, 13; tuberculin negative and histoplasmin positive, 23; both tests negative, 7.

The author attempted to find some characteristic by which calcification presumably due to histoplasmosis can be distinguished radiologically from that presumably due to tuberculosis. No convincing characteristic was discovered to distinguish the two, although it was felt that bilateral calcification is more often associated with a positive histoplasmin test (6 to 1).

This article supports others in the literature which suggest that pulmonary calcification is often due to histoplasmosis. T. F. WEILAND, M.D.
Jefferson Medical College

Shell-Form Hilar Calcifications Without Silicosis. H. Eggenschwyler. Radiol. clin. **19:** 77–81, March 1950. (In German)

Shell formations of calcium in the lymph nodes of the lung parenchyma, lung roots, and mesentery are usually regarded as due to silicotic changes and are often called "silicotic eggshells." Many of these are observed as ring-like shadows in the periphery of the slightly enlarged lymph nodes, anatomically corresponding to a zone of subcapsular calcification. Cases showing this type of change had not previously been found either in the literature or in the author's material without some evidence of exposure to silica. The appearance has therefore been regarded as pathognomonic of silicosis with or without tuberculosis.

Recently, a case has been discovered with definite calcium shell formation in the lymph nodes in which no exposure to silica dust could be determined. The patient was a 73-year-old housewife who had worked in a silk factory from the age of fourteen to fifty-three. An exhaustive search revealed nothing to indicate any exposure to silica dust. However, dense shell-like calcium deposits, 0.5 to 3 cm. in diameter, were seen about the periphery of the hilar nodes bilaterally, the central portions being clear. Small nodules were observed in the parenchyma averaging 2 to 4 mm., and slightly larger nodules in the right apex, up to 8 mm. in diameter.

The question arises as to how such calcium deposit originated. Since lack of any factors of silicosis is considered definitely established, the probability of a purely tuberculous origin must be seriously considered. At all events, shell-like calcifications in the lymph nodes of the hilar region and lungs can no longer be regarded as positive proof of silicosis.

Two illustrations. E. W. SPACKMAN, M.D.
Fort Worth, Texas

Syphilitic Gumma of the Lung. Curtillet, Bies and Portier. J. franç. de méd. et chir. thorac. **4:** 289–292, 1950. (In French)

A case is presented of a 58-year old female who presented a chronic pneumopathy of five years' duration.

Radiologic examination revealed a rounded opacity in the base of the right lung. A positive serologic reaction led to a therapeutic test with mapharsen and penicillin. The patient improved clinically and only a small scar remained in the lung roentgenogram.

Although syphilitic gumma of the lung is rare, the roentgenologist must be aware of its possible occurrence and keep it in mind in the differential diagnosis of chronic chest disease.

CHARLES NICE, M.D.
University of Minnesota

X-ray Examination in "Pneumonia." N. Wynn-Williams. Brit. M. J. **1:** 579–582, March 11, 1950.

This article has been written in an attempt to assess the usefulness of roentgenography in cases of "pneumonia." From an analysis of 228 cases of the disease, the author feels that there is little doubt about the value of a roentgen study as an extra aid to diagnosis. It is wiser to err on the side of safety by taking a roentgenogram which shows no abnormality than to procrastinate with the risk of disease progressing. Roentgenography is justified in pneumonia if only as a method of diagnosing phthisis. In this series, 25 active and 4 inactive cases of pulmonary tuberculosis were disclosed.

Three tables.

DANIEL WILNER, M.D.
Atlantic City, N. J.

Bronchial Stenosis by Non-Specific Inflammation. J.-M. Lemoine and Y. Rose. J. franç. de méd. et chir. thorac. **4:** 254–256, 1950. (In French)

Bronchial stenoses usually present a demonstrable etiology. Tuberculosis is the most common cause. Syphilis may rarely produce cicatrization due to an ulcerated gumma. Stenosis produced by compression or infiltration of tumors does not usually present a difficult diagnostic problem. The case of a 52-year-old male who was struck in the chest by a metallic fragment from a tank gun thirty-one years previously is presented. The fragment did not penetrate to the depth of any of the major bronchi, so it is concluded that a chronic bronchitis arose secondary to pulmonary suppuration, and in turn gave rise to bronchostenosis and bronchiectasis.

CHARLES NICE, M.D.
University of Minnesota

Pneumothorax in the Newborn Infant. James E. Strain and John R. Connell. J. Pediat. **36:** 495–500, April 1950.

Although pneumothorax in the newborn is not common, it occurs often enough to merit consideration when cyanosis and dyspnea develop shortly after birth. Since physical signs are often absent, roentgenography may be the only reliable means of diagnosis. Interpretation of the films usually offers no difficulty, but occasionally the possibility of a diaphragmatic hernia or giant congenital lung cyst must be considered. In infants requiring aspiration prompt recognition of the condition may be life-saving. Prognosis in infants less than a day old is poor. Treatment of choice in patients developing pneumothorax later is usually conservative: oxygen, carbon dioxide inhalations, and prophylactic penicillin. If the pneumothorax is bilateral and so extensive that it causes serious respiratory embarrassment, aspiration of the entrapped air is indicated.

A case of bilateral pneumothorax in a 4-day-old infant born by cesarean section is reported.

Three roentgenograms.

Loeffler's Syndrome with Skin Manifestations. Albert M. Jones and Evelyn B. Ogle. J. Pediat. **36:** 505–507, April 1950.

A case of Loeffler's syndrome in a 2-year-old child is presented. The patient was admitted to the hospital because of rash and fever. The temperature was 104° F., pulse 92, and respirations 20. Physical examination was otherwise essentially normal except for irregularly shaped erythematous macular lesions on the face, neck, trunk, and dorsal surface of the feet, with those on the lower stomach having a bluish tinge. The first roentgenograms were reported as showing a bilateral bronchopneumonia. A week later there was a considerable increase in the size and density of both hilar shadows and considerable peribronchial infiltration throughout both lung fields, and in another week a still further increase in the infiltration was observed. By the eighth hospital day the skin was normal and the child appeared well, but x-ray evidence of improvement of the pulmonary infiltration was not seen until three or four weeks later, at which time there was an eosinophilia of 29 per cent. The authors accept the allergic theory of Loeffler's syndrome and consider the rash in this case to be a part of the allergic response.

The Role of Dual Reading in Mass Radiography. J. Yerushalmy, J. T. Harkness, J. H. Cope, and B. R. Kennedy. Am. Rev. Tuberc. **61:** 443–464, April 1950.

An extensive study to determine the value of dual reading in photo-fluorographic chest surveys is reported. The routine examination of 1,807 students by means of 70-mm. films was accomplished, and the films were interpreted by a panel of six radiologists and chest specialists to determine the "truly positives" and the "truly negatives." Four of the panel provided two readings each, so that a total of ten readings for each film were available.

As a result of the ten interpretations, 254 photoflurograms were called positive on more than one reading, and in these cases 14 × 17-inch films were taken. Thirty films were interpreted by unanimous agreement as requiring clinical follow-up and are considered "truly positive"; 12 were classed as questionable, and the remainder as negative. Thus the over-all finding was 1,760 "truly negative" and 30 "truly positive" films.

With the total of 1,790 films in which there was agreement, a number of studies were made to determine the methods whereby dual reading could be utilized to the best advantage. The problem of false diagnosis was found to be of considerable magnitude, with an average of 32.2 per cent of the "truly positives" missed by the average single reader. When two readers interpreted the films, the increase in positives found was 34 per cent, but the number of false positives was doubled. Nearly the same results can be anticipated when a second independent reading is performed by the same reader. A single competent reviewer or a panel of three reviewers can be expected to eliminate nearly all of the false positives and to detect 30 per cent of the positives missed by a single reader. Therefore, the authors feel that dual independent readings should be made by a single reader or by two different readers. Then a single reviewer or a panel of reviewers should go over all films which were called positive on only one of the readings in an attempt to determine the "truly positives," and to eliminate the false positives.

Nine tables.

JOHN H. JUHL, M.D.
University of Wisconsin

Multiphasic Screening Examinations—An Extension of the Mass Screening Technique. Lester Breslow. Am. J. Pub. Health **40:** 274–278, March 1950.

Mass chest x-ray surveys using photofluorographic equipment and mass serologic testing programs for the detection of syphilis are well established preventive methods. Recently comparable screening technics have been developed for early detection of diabetes, heart disease, and cancer of certain sites. In contrast to periodic health examinations, these screening procedures are capable of very wide application; they are relatively inexpensive per person tested and they require relatively little time on the part of the physician. They have been used, for the most part, in separate case-finding programs.

The author suggests that separate screening methods be combined into a single multiphasic screening procedure for the detection of tuberculosis, syphilis, diabetes, heart disease, and cancer. By combining tests for these several diseases, one would expect to find, in a multiphasic screening of 1,000 persons, approximately 20 to 30 persons who have significant disease requiring the continuing attention of a physician.

It is emphasized that the multiphasic examination is a screening procedure and only suggests the final diagnosis. Definitive studies are needed after the screening procedure gives the lead. These further studies should be performed where the patient is to receive his medical care.

HOWARD L. STEINBACH, M.D.
University of California

Transverse Axial Stratigraphy in Disease of the Mediastinum. Germano Buzzi. J. de radiol. et d'électrol. **31:** 146–153, 1950. (In French)

Since there are many pathologic processes involving the numerous structures in the mediastinum, the diagnosis of any individual case may be difficult and require all the resources available to the clinician and radiologist. Radiologic diagnostic procedures include radiographs in various projections, fluoroscopy, bronchography, contrast visualization of the esophagus and great vessels, and both anteroposterior and lateral stratigraphy (tomography, planigraphy).

Vallebona pioneered the study of coronal planes by means of the method of stratigraphy or tomography and also by third-dimensional or transverse axial stratigraphy (see Radiology **55:** 271, 1950). The technic of this last procedure is not given in detail here, but consists essentially in directing the x-ray beam at an angle toward any desired level while the seated patient and the film are being rotated in opposite directions. This principle of movement in opposite directions by patient and film explains the "blurring out" of all images except in the desired plane.

By adding the third-dimensional aspect to radiologic study a more precise knowledge of the location, size, and configuration of mediastinal lesions may be obtained.

Fifteen roentgenograms.

CHARLES NICE, M.D.
University of Minnesota

Chondrosarcoma of the Posterior Mediastinum with Hourglass Involvement of the Spinal Canal: Resection and Recovery. Report of a Case. Wilson Weisel and Willard B. Ross. J. Thoracic Surg. **19:** 643–648, April 1950.

A 40-year-old white male complained of numbness of the lower half of the body, inability to walk, and sudden inability to void. Roentgenograms revealed a mass in the posterior left chest with erosion of the left pedicles of the adjacent sixth and seventh thoracic vertebrae. Myelography showed spinal cord compression at the same level. The tumor was removed through a posterolateral thoracotomy. Portions of the vertebral body, laminae, rib heads, pedicles, lung, and dura were excised. Pathological study showed the tumor to be a chondrosarcoma. The patient made a complete recovery and sixteen months later showed no evidence of recurrence.

Two roentgenograms; 2 photographs.

HAROLD O. PETERSON, M.D.
University of Minnesota

Contribution to the Roentgen Diagnosis of Multiple Aneurysms of the Pulmonary Artery. H. Weise. Fortschr. a. d. Geb. d. Röntgenstrahlen **72:** 345–349, January 1950. (In German).

Aneurysm of the pulmonary artery and its branches is demonstrated on the x-ray film by prominence of the pulmonary segment, sometimes associated with a dense rounded shadow or multiple shadows in the region of the hilus. They are sometimes difficult to differentiate radiologically from other mass lesions in the hilar region. Similar appearance is given by bronchogenic carcinoma, metastatic carcinoma, lymphosarcoma, tuberculous nodules, lymphomas, local areas of pneumonitis, infarct, and less common conditions such as the benign tumors, cysts, dermoids, gumma, etc. Many of these can be eliminated since aneurysms show little progressive enlargement during periods of months or years and reveal an expansile type of pulsation under the fluoroscope.

The author mentions the congenital origin as a fault of division of the truncus. Associated anomalies are often present, such as patent ductus arteriosus, pulmonary stenosis, defects in the walls of the heart chambers, and transposition of the vessels. Contributing causes may be mitral stenosis, general pulmonary infections such as bronchitis, emphysema, etc., and increased pressure within the lesser circulation. Cases have been described following trauma and due to septic emboli, syphilis, and toxic causes, particularly polyarthritis. Usually the main artery or one of its major subdivisions is involved.

In the author's case the rounded dense shadows were caused by aneurysms involving the minor divisions of the pulmonary artery. The patient, a male aged 52, previously healthy, had polyarthritis three years previously, resulting in a double mitral lesion and enlargement of the heart. Multiple rounded dense shadows were observed in both hilar regions but were attributed to the heart condition and not considered as representing aneurysms at that time (1946). These varied from approximately the size of a cherry to that of a plum.

Three years later (1949) the patient was admitted to the clinic because of cyanosis and dyspnea, but showed no edema. Systolic and prediastolic murmurs were present. The heart was greatly enlarged, especially to the left. The pulmonary segment was enlarged, expanded, and showed marked pulsation. The masses in the hilar region were seen to pulsate actively and synchronously with the pulmonary artery segment. Although there was some slight increase in heart size and in size of the hilar densities, generally little change was observed in the x-ray appearance during this three-year period. The electrocardiogram did not show right

axis deviation but indicated an atypical Wilson bundle-branch block. The lung fields were otherwise clear. No clinical features contributed directly to the diagnosis.

It was considered most unusual in the case described that the multiple aneurysms appeared to involve the secondary divisions of the pulmonary artery rather than the main stem or its major divisions. The condition was considered on a toxic basis, very likely resulting from the polyarthritis.

Four illustrations. E. W. SPACKMAN, M.D.
Fort Worth, Texas

Large Obstructive Emphysematous Bulla of the Right Lung in the Course of an Aneurysm of the Aortic Arch. H. Tillier, A. Portier, and C. Boulard. J. de radiol. et d'électrol. **31:** 213–214, 1950. (In French)

A patient was seen on two occasions and a diagnosis was made of a large aortic aneurysm. On a third entrance to the hospital a large emphysematous bulla was noted in the right upper lung field. A short time later the entire left hemithorax was opaque, suggesting atelectasis of the entire left lung. Death occurred after a large hemoptysis following perforation of the aneurysm into the trachea.

Three roentgenograms. CHARLES NICE, M.D.
University of Minnesota

Incidence of Cardiac Enlargement in Nondisabling Rheumatic Valvulitis. Arnold L. Bachman. Am. Heart J. **39:** 405–412, March 1950.

The author presents the results of a roentgenographic study of a group of young soldiers with asymptomatic rheumatic valvulitis. Of 47,000 soldiers receiving flying status examination, 82 were found to have rheumatic valvulitis. None of them gave any history of cardiac functional impairment, and all were able to undergo vigorous physical training. Mitral insufficiency was diagnosed in 53, mitral stenosis in 2, aortic insufficiency in 5, and combined lesions in 22. Twenty-eight gave a positive history of rheumatic fever. The distribution of valvular lesions was about the same in this latter group as in those with no history of rheumatic fever.

Only 34 of the 82 men with valvular disease showed cardiac enlargement. In 70 the pathologic process was limited to the mitral valve, and of these only 27 showed some deviation from normal on the x-ray film of the heart. This group was further subdivided: 19 of 53 with isolated mitral insufficiency and 8 of 15 with double mitral lesions showed abnormal heart shadows. Two of the 5 with aortic insufficiency, 1 of the 3 with double aortic lesions, and all 4 with combined mitral and aortic lesions showed roentgenologic abnormalities.

Left auricular enlargement was observed in 24 of the 82. It was present in 15 of the 53 with mitral insufficiency, 7 of the 15 with double mitral lesions, and 2 of the 4 with combined mitral and aortic lesions. It is evident that many individuals with undoubted rheumatic valvular disease may show no cardiac enlargement and no cardiac embarrassment.

Five tables. HENRY K. TAYLOR, M.D.
New York, N. Y.

Angiocardiography in the Diagnosis of Cardiovascular Syphilis. George E. Peabody, George G. Reader, Charles T. Dotter, Israel Steinberg, and Bruce Webster. Am. J. M. Sc. **219:** 242–248, March 1950.

Eighty-three cases of late syphilis were studied by angiocardiography to evaluate the usefulness of the method in the diagnosis of cardiovascular syphilis. Following the rapid injection of 70 per cent diodrast, serial exposures were made in the left anterior oblique view, which best showed the aortic arch. Measurements were made of the aortic diameters and these were compared with those obtained from 100 normal subjects including those with atherosclerotic changes. Certain structural alterations were found as a consequence of syphilitic aortitis.

1. Dilatation of the mid-ascending aorta beyond 38 mm.
2. Irregularity of the lumen of the ascending aorta.
3. Variations in the thickness of the aortic wall.
4. Calcification of the ascending aorta, localized by angiocardiography.
5. Tortuosity of the aorta.

Angiocardiography showed cardiovascular syphilis in 15 cases which had been missed on physical examination and conventional chest roentgenography. In 34 cases it excluded cardiovascular involvement, which had been suggested by physical findings in 21 and by chest films in 7. The remaining 34 cases were diagnosed by other methods, and angiocardiography was corroborative.

It is concluded that angiocardiography is valuable in the early diagnosis of cardiovascular syphilis, especially in the late latent type of the disease, where other methods may give negative misleading results.

Six roentgenograms; 2 tables.
CORNELIUS COLANGELO, M.D.
Chicago, Ill.

The Residual Blood of the Heart. A Clinical X-Ray and Pathologico-Anatomical Study. Carl-Eric Friedman. Am. Heart J. **39:** 397–404, March 1950.

By residual blood the author means the volume of blood in the heart chambers after systole. His investigation of this subject comprised two parts: The first consisted in calculation of residual blood during life in 6 patients having decompensated rheumatic valvular disease with considerable cardiac enlargement. The second part involved a comparison of the heart volume as determined by postmortem teleroentgenography and the volume of the heart which had been removed from the body with all the vessels ligated, as estimated by the displacement method. The latter study included the 6 subjects with rheumatic disease observed during life and 4 with normal heart volume.

The postmortem determinations were made by x-ray using the same focal distance—1.5 meters—as was used in the determinations during life. For the displacement studies the heart was placed in a vessel filled with water, and the volume of displaced water measured. This corresponded almost exactly to the volume of the heart. The heart was then weighed, the cavities were emptied, and the residual blood was measured. Finally, the volume and weight of the empty heart muscle were calculated.

The postmortem studies revealed a discrepancy of less than 5 per cent between the heart volume as calculated by x-ray and the measurements of the extirpated heart by the displacement method.

The investigations revealed that during life the decompensated heart contains considerable quantities of residual blood, over half the total volume of the organ.

There is an obvious discrepancy between the volume of the heart before and after death. Rigor mortis is responsible for some decrease in heart volume. Static changes, as well as the expiratory state, may also contribute to the decrease in volume.

Twenty-four roentgenograms; 2 graphs.

HENRY K. TAYLOR, M.D.
New York, N. Y.

Intracardiac Catheterization. Walter T. Zimdahl and Don W. Chapman. Ann. Int. Med. **32:** 489–505, March 1950.

The authors present a group of 25 patients who have had venous catheterization of the right heart. The method is as follows: A 100-cm. radiopaque ureteral catheter (6 or 9 F.) is inserted in the median basilic vein under local anesthesia with strict sterile precautions. An isotonic saline solution containing heparin is maintained at a slow drip controlled by a tunnel clamp. With the patient in the supine position, under fluoroscopic control, the catheter is passed through the subclavian vein, superior vena cava, the right atrium, the right ventricle, pulmonary conus, pulmonary artery, and its branches, whenever possible. Samples of blood are then drawn under oil from the various sites, and are analyzed by the manometric method of Van Slyke for oxygen content. These results are correlated with clinical findings.

The normal variation of the oxygen content in the various chambers of the heart has been established. The normal variation between the superior vena cava and right auricle is 1.9 volumes per cent, between the right auricle and right ventricle 0.9 per cent, between the right ventricle and pulmonary artery 0.5 per cent, and within the pulmonary branches themselves 0.5 volume per cent.

The diagnosis of a patent ductus arteriosus is made when a significantly greater oxygen content is present in the pulmonary artery than in the right ventricle. A diagnosis of interauricular septal defect can be made either by introducing the catheter through the auricular septal defect or finding a significant increase in the oxygen content of blood in the right auricle (left to right shunt) as compared to that obtained from the superior vena cava. The recognition of interventricular septal defect depends upon finding a significant increase in the amount of oxygen in the right ventricle as compared with the right auricle.

It is not to be expected that the tetralogy of Fallot can be recognized in its entirety by study with the venous catheter. Right ventricular hypertrophy is perhaps best indicated by the electrocardiogram. Dextroposition of the aorta is largely a morphological diagnosis and is functionally indistinguishable from a ventricular septal defect in catheterization studies. Pulmonary stenosis has been assumed to exist if the systolic pressures in the aorta and right ventricle are identical. In most cases the systemic flow exceeded that through the pulmonary artery, indicating that the over-all direction of the intracardiac shunt is from right to left. Consequently the systemic blood flow will be particularly high in individuals with severe pulmonic stenosis, large interventricular septal defects, and marked over-riding of the aorta.

The authors encountered no major complications with this procedure. The following is a breakdown of their findings in 25 patients:

Group I. Interatrial septal defects	5
Group II. Interventricular septal defects	4
Group III. Patent ductus arteriosus	8
(*a*) Four confirmed and ligated at operation	
(*b*) Four confirmed by catheterization, not operated upon	
Group IV. Congenital heart disease suspected	3
(*a*) Normal gas volumes obtained	
Group V. Congenital heart disease with normal oxygen volumes obtained	2
Group VI. Combined lesions:	
(*a*) Patent ductus arteriosus and interventricular septal defect (the patent ductus confirmed by operation)	2
(*b*) Patent interatrial septal defect and anomalous pulmonary vein	1

Combined congenital cardiovascular lesions are more difficult to diagnose and evaluate. Ten cases in the potentially cyanotic class of congenital anomalies are presented in detail. In one patient, one of the pulmonary veins emptied into the superior vena cava.

Fourteen roentgenograms; 7 electrocardiograms.

STEPHEN N. TAGER, M.D.
Urbana, Ill.

Lessons of Aortography. René Leriche, Jean Kunlin, and Colette Boély. Angiology **1:** 109–132, April 1950.

Aortography, according to the technic of dos Santos, has been used by the authors in the following conditions, in addition to the diagnosis of abdominal tumors: (1) in impotent men, with no erections; (2) in patients complaining of extreme fatigue in walking but without real intermittent claudication; (3) in individuals with arteritis. Their conclusions are based on the study of 100 cases.

In 25 per cent of the men in the first group, men still young, tortuosities and dilatations of the iliac system were found.

In patients complaining of fatigue on walking, with no signs of peripheral occlusive arterial disease, aortography showed either irregular dilatation of the iliac arteries or stenosing calcifications. Stenosis may be accompanied by iliac dilatations and sometimes obliteration of the femoral artery.

In individuals with peripheral occlusive arterial manifestations, aortography revealed partial or complete obliteration of the common iliac and extensive obliteration of the entire iliac system on one or both sides, as well as frequent aortic obliteration. Aortic obliterations usually commence with an iliac thrombosis, at first unilateral, then bilateral. They may originate in the aortic spur. They may reach the lower mesenteric artery but have never been found by the authors to extend to the renal artery even after a very long period of development.

Twenty-two aortograms.

Electrokymography. R. Pannier, A. Van Loo, and Ch. Van Beylen. J. belge de radiol. **33:** 1–26, March 1950. (In French)

This study is concerned with the principles and the clinical use of electrokymography. Technical aspects are considered, and curves obtained in normal subjects are analyzed. Electrokymography furnishes valuable information concerning the kinetics of the various segments of the heart and great vessels. The curves ob-

tained in cardiovascular disease may then be compared with the normal.

In aortic insufficiency, the electrokymogram of the aortic arch is characterized generally by a very strong amplitude of the movements. Systolic expansion occurs sooner than in the normal, and the diastolic retraction is more rapid because of the reflux through the insufficient aortic valve. The left ventricular curve reveals an effacement of the transition between the isometric contraction and the phase of rapid ejection.

In coarctation of the aorta the patient is placed in the left anterior oblique position, and curves above the area of constriction are essentially normal, while those below the constriction are flattened.

In mitral insufficiency the left atrium shows a systolic expansion coexistent with the ejection phase of the left ventricle.

Valuable information may be obtained to aid in differentiating pulsatile and non-pulsating tumors of the mediastinum. Aortic aneurysms give a different pulsation than dilated pulmonary arteries or mediastinal tumors.

In normal subjects the time of left and right ventricular ejection does not differ more than 0.03 second. Ventricular asynchronism beyond 0.03 second indicates bundle-branch block, as seen in the electrocardiogram. There is also a difference in the transmitted waves in the aortic and pulmonary artery segments. In ventricular aneurysm due to infarction paradoxical movement is noted at the involved level.

Fourteen figures demonstrate normal and abnormal tracings.

CHARLES NICE, M.D.
University of Minnesota

THE DIGESTIVE SYSTEM

Roentgen Diagnosis of Abnormalities of the Esophagus with Special Attention to Some of the Less Common Lesions. James B. Douglas, Gerald M. Peterson, and Joseph C. Bell. South. M. J. **43:** 223–229, March 1950.

The authors present a concise review of the main points of roentgen diagnosis of some of the abnormalities and lesions of the esophagus.

The most significant congenital anomalies of the esophagus are tracheo-esophageal fistulae, both with and without atresia of the esophagus. It is most important that iodized oil rather than barium be used in the roentgen examination of these cases. Congenital anomalies of the great vessels, such as retro-esophageal aorta or an aberrant innominate artery passing behind the esophagus, may cause dysphagia. Many diaphragmatic hernias are associated with congenital abnormalities of the esophagus.

The pulsion type of esophageal diverticulum may attain appreciable size and seriously interfere with the normal swallowing function. Such diverticula present posteriorly in the region of the cricopharyngeus muscle. Traction diverticula generally occur in the middle third of the esophagus and are seldom of clinical significance.

"Curling," or Templeton's "tertiary contractions," producing a corkscrew appearance of the esophagus, occasionally occur in older individuals. Symptoms may result in the severe cases.

Achalasia, manifest as a smooth concentric constriction at the level of the hiatus, frequently associated with dilatation, is one of the most frequent disturbances in esophageal function. Its exact mechanism is still controversial.

Acrosclerosis and scleroderma are accompanied by dysphagia in 10 per cent of the cases. Early in the disease, the fibrosis of the esophageal muscle results in impairment or absence of peristalsis with delay in emptying, particularly of solid foods. Cicatricial changes result in stenosis of the lower esophagus just above the phrenic ampulla or in esophageal shortening and retraction of the stomach through the hiatus.

Opaque foreign bodies offer no particular problem providing they are large and dense enough to be seen on films. The authors have found it advantageous to have the patients swallow pledgets of cotton soaked in barium, especially when searching for small sharp objects such as fish bones.

Benign neoplasms are much less common than are carcinomas. Carcinomas frequently involve the distal half of the esophagus and the infiltrating constricting lesions are most common. Carcinoma of the cardia of the stomach frequently involves the distal esophagus and interferes with emptying.

Thoughtful clinical evaluation, roentgen examination, and esophagoscopy are frequently all essential in adequate care of these patients, and the recent developments in surgical technic make early and accurate diagnosis of esophageal abnormalities imperative.

Eighteen roentgenograms.

ROBERT H. LEAMING, M.D.
Jefferson Medical College

Leiomyoma of the Esophagus. Alfred Goldman and Harold Masters. Arch. Surg. **60:** 559–574, March 1950.

Leiomyoma of the esophagus is an uncommon neoplasm which must be thought of in all cases of esophageal tumor producing a smooth filling defect or irregularity not involving the mucosa on roentgen examination. It is more common in the distal esophagus. Enucleation of the growth without entering the esophageal lumen is desirable, but the lesion may surround the esophagus in such a manner as to make resection necessary. The operative approach is best determined by the position of the tumor and the question as to whether or not the stomach must be mobilized, so that the preliminary diagnosis of this point is important. The literature is discussed, and 2 cases with successful removal are recorded.

Four roentgenograms; 2 photographs; 3 photomicrographs; 2 tables.

LEWIS G. JACOBS, M.D.
Oakland, Calif.

Scleroderma of the Inner Organs. Eugen Jaeger. Fortschr. a. d. Geb. d. Röntgenstrahlen **72:** 350–352, January 1950. (In German)

Scleroderma is considered as primarily a change in the vessels with vasoconstriction as the earlier stage, subsequent dilatation associated with hypertrophy of the connective tissue, and finally atrophy of the skin. The end vessels are involved to the greatest degree and because of the vessel narrowing blood and serum permeate through the surrounding tissues and result in hyperplasia of the connective-tissue elements. The capillaries are choked off by connective-tissue proliferation and a relative ischemia is produced, with slowing down of the circulation through the affected parts. This type of reaction can involve any or all of the inner organs as well as the skin and subcutaneous tissues, particularly the esophagus, lungs, heart, liver, and kidneys, and also the glands and organs of internal secretion. These are secondarily affected.

The x-ray changes in the esophagus are typical, consisting of dilatation, flabbiness, absence of peristalsis, thickening of the walls, retention of food or barium and, often on plain film studies, demonstration of air within the esophagus.

Changes somewhat similar to those in the esophagus may be found in the stomach, small intestine, and occasionally in the colon, with absence of peristalsis, dilatation of individual loops of intestine, and lack of the normal flexibility. The colon may show a tendency to puddling of the barium and segmentation. Cystic types of change are found in the lungs, particularly in the lower portions.

A case is reported of a 38-year-old man with vague gastric complaints over a period of thirty years. Various areas of hardening and thickening of the skin were found by palpation, especially in the face, axillae, and abdominal areas. The esophagus showed the most typical changes. The stomach was normal but the duodenal bulb was deformed. Passage through the small intestine was not delayed and the colon showed no abnormal changes.

Two illustrations.

E. W. SPACKMAN, M.D.
Fort Worth, Texas

Oesophageal Hiatus Hernia of the Cardiac End of the Stomach Associated with a Second Oesophageal Hiatus Hernia Containing Omentum. Report of an Unusual Case. F. P. Jacobsz. South African M. J. **24:** 105–106, Feb. 18, 1950.

A case of esophageal hiatus hernia of the cardiac end of the stomach in a 74-year-old female, with a second esophageal hiatus hernia containing omentum, is reported. The paper deals chiefly with the operative technic and the advantages of the transthoracic approach.

Three roentgenograms.

An Experimental Study of the Blood Supply of the Esophagus and Its Relation to Esophageal Resection and Anastomoses. John L. Shek, Carlos A. Prietto, W. M. Tuttle, and E. J. O'Brien. J. Thoracic Surg. **19:** 523–533, April 1950.

The authors performed a series of operations on 32 dogs in which different lengths of the esophagus were resected and it was freed of its thoracic blood supply in varying amounts. In 6 animals, even though its entire thoracic blood supply was cut off, the esophagus was found to remain viable. In some of the animals, after obliteration of the thoracic blood supply, esophageal resections and anastomoses were done, with good healing. In others, the left gastric, left gastro-epiploic, and short gastric arteries were divided after removal of the thoracic blood supply. In this group also the esophagus remained viable and esophageal resection with anastomosis was followed by healing.

In some of the animals a mixture of 18 per cent bismuth oxychloride in 35 per cent diodrast was injected into the right gastric or the left gastric or the right gastro-epiploic arteries. In these instances, after injection of the dye in the living animal, the entire stomach and esophagus were resected and films were made of the specimens. In all cases a blood supply to the esophagus from the stomach was demonstrated.

Twelve illustrations, including 4 arteriograms.

HAROLD O. PETERSON, M.D.
University of Minnesota

Gastric Secretion and Motility as Influenced by Tetraethyl Ammonium Compounds. M. R. Castex, A. L. C. Maggi, and M. Meeroff. Prensa méd. argent. **37:** 404–412, March 3, 1950. (In Spanish)

Burn and Dale in 1912 demonstrated that tetraethyl ammonium in mammals stimulated the vagal nerve endings and raised arterial pressure because of a nicotinic action; that is, by making the ganglion cells more receptive to the impulses brought by the preganglionic fibers. In larger doses, however, this action was reversed. Of late years this drug has been studied enthusiastically in France. The French have preferred the bromide, while in the United States the chloride has been elected, administered exclusively by the intramuscular route.

Experiments have shown that tetraethyl ammonium in appropriate dosage causes a diminution of the gastric secretion, especially in the interim between digestive periods. It relieves nocturnal pain and maintains its effect for a very appreciable length of time. It is valuable in combating hyperchlorhydria and it reduces hypersecretion. It aids in determining which cases will respond to the Dragstedt operation. As for gastric motility, the effect on the stomach lasts three hours and on the intestine eight hours, following doses of 20 mg. per kilogram of body weight given by intramuscular injection.

The authors studied 15 cases, 14 of ulcer and one of carcinoma. Intramuscular injections of 15 mg. of tetraethyl ammonium per kilogram of body weight were given not less than three hours before the radiologic control. The effect of the medicament was much more evident on the contractility than on the tone of the stomach.

It was estimated that gastric muscular tone was reduced in approximately 50 per cent of the cases. The action on gastric contractility was manifest in 90 per cent.

The drug is valuable not only in the treatment of the pain of gastroduodenal hypermotility in various diseases, especially ulcer, but also following resection of the stomach. The post-gastrectomy "dumping syndrome," which appears at once after eating, is considered to be due to vagal hypertonus. It would be proper to test such a stomach with the drug before proceeding to vagotomy. The authors assume that there is a similar inhibitory action on intestinal motility.

Eight roentgenograms; 2 charts; 12 graphs.

JAMES T. CASE, M.D.
Chicago, Ill.

Early Diagnosis of Gastric Cancer. David State, David Gaviser, T. Brannon Hubbard, and Owen H. Wangensteen. J. A. M. A. **142:** 1128–1132, April 15, 1950.

Four criteria were used at the cancer detection clinic of the University of Minnesota on all patients past the age of fifty to select candidates for examination for possible gastric carcinoma. The criteria were: (1) histamine achlorhydria or hypochlorhydria (especially with three injections of histamine); (2) the presence of pernicious anemia; (3) a family history of gastric cancer; (4) blood in the stool and/or anemia. Patients so selected were studied roentgenologically and in some instances gastroscopically with the following results:

In a group of 94 patients having pernicious anemia, 4 polyps and 3 gastric cancers were found.

Among 1,450 patients with hypochlorhydria or

achlorhydria, 38 (2.6 per cent) showed polyps and 8 (0.5 per cent) carcinoma.

No polyps or malignant growths were found in a small group of patients having a family history of gastric cancer, in patients with occult blood in the stool, or in patients with hemoglobin of 11 gm. or less.

Taking the four groups together, 2.9 per cent were found to have polyps and 0.6 per cent carcinoma. Since this represents a much greater yield of malignant or premalignant lesions than is found when the screening criteria are omitted (3 out of 1,715, or 0.17 per cent), the authors conclude that the latter are justified.

An additional interesting observation was a high incidence (11 per cent) of rectal polyps in all patients over forty-five years in whom proctoscopy was done routinely as part of the cancer detection examination.

Eight tables. CORNELIUS COLANGELO, M.D.
Chicago, Ill.

Gastric Cancer: Difficulties in Recognition at Laparotomy. John W. Findley, Jr., Joseph B. Kirsner, and Walter L. Palmer. Gastroenterology **14:** 502–508, April 1950.

The authors describe four cases seen within a space of four months during 1948, with an unusual sequence of events: failure to detect at operation non-ulcerating gastric carcinomas previously diagnosed and subsequently proved to be present. Three patients required a second operation; resection was carried out initially in the fourth patient because of the insistence of the physician who had seen the tumor gastroscopically. In these instances roentgenologic and gastroscopic observations were more accurate than direct inspection and palpation of the unopened stomach.

The chief difficulty in the early diagnosis of gastric cancer in many cases is the absence of symptoms until the tumor has occupied a large portion of the stomach and, too often, neighboring organs. It is thus all the more regrettable to establish the diagnosis at a relatively early stage of growth, only to find that resection is not performed because the lesion is not detected at operation. These cases are presented to emphasize the fact that, in the presence of definite roentgenologic and gastroscopic evidence of gastric cancer, the stomach should be opened and inspected, and, if no tumor is found, a biopsy specimen should be obtained.

Six roentgenograms. DANIEL WILNER, M.D.
Atlantic City, N. J.

Clinical and Pathological Studies of Benign and Malignant Gastric Ulcers. Orville F. Grimes and H. Glenn Bell. Surg., Gynec. & Obst. **90:** 359–371, March 1950.

Although the technic of gastric surgery has greatly improved in the past decade, there has not been a significant increase in the number of five-year survivals of patients who have been operated on for carcinoma of the stomach and neither has there been encountered a greater number of early and small gastric carcinomas. If the results of treatment of gastric cancer are to improve, effort must be directed at those lesions which disclose their presence by ulcer-like symptoms.

Present diagnostic methods cannot be depended upon to differentiate between benign and malignant gastric ulcers. The incidence of benignity in groups of patients arranged according to age and duration of symptoms is not of sufficient magnitude to allow certainty of diagnosis. Ulcers located in the prepyloric region, along the greater curvature, and high on the posterior wall are more apt to be malignant while, in the majority of cases, those situated along the lesser curvature are benign, but it should be emphasized that ulcers in any part of the stomach may be malignant. The presence or absence of hydrochloric acid in the stomach is not reliable as a criterion upon which a diagnosis can be based. The size of the lesion is also of questionable diagnostic value in the individual case.

Most observers agree that carcinomatous change may take place in gastric ulcers. Others are of the opinion that all malignant ulcers are the result of peptic ulceration of primary carcinomas, but, if this is true, certain carcinomas of the stomach must be of an extremely low grade of malignancy and manifest slow growth. The natural history of gastric carcinoma does not bear this out. It is likely that both phenomena occur. Regardless of which view is held, it is an established fact that ulcer anywhere in the stomach may be malignant.

In spite of the recognized incidence of malignancy in gastric ulcer, a medical regimen is often continued beyond the period necessary to determine the true nature of the lesion. Roentgenologic follow-up examinations have to be relied upon to evaluate the progress of medical therapy, but these studies do not completely solve the problem. A false sense of security is frequently obtained due to the fact that malignant as well as benign ulcers may show x-ray evidence of healing. Proliferation of malignant tissue may obliterate the crater and simulate healing of a benign lesion.

Although medical treatment of gastric ulcer is often highly successful, the certainty of diagnosis by surgical means favors the surgical approach to the problem. Ulcers that are shown roentgenologically to be located high on the lesser curvature or high on the posterior wall are often treated medically because they are believed to be surgically inaccessible. The roentgen appearance may indicate that they are in such close proximity to the esophago-gastric junction that only total gastrectomy will make excision possible. The mobilization of the ulcer-bearing portion of the stomach from the adjacent structures and the early division of the gastro-hepatic ligament will frequently allow the foreshortened stomach to assume its normal length. The amount of uninvolved stomach above the ulcer may be considerable.

Twenty-eight illustrations, including 11 roentgenograms. RODERICK L. TONDREAU, M.D.
Lincoln, Nebr.

Roentgenological and Pathological-Anatomical Picture of Chronic Phlegmon of the Stomach. C. Buetti and P. Loustalot. Radiol. clin. **19:** 65–76, March 1950. (In German)

In the entire world literature approximately 400 cases of phlegmon of the stomach have been reported, and only a few of these have been recognized by x-ray studies. Most of this number were in the acute or subacute stage, chronic cases being exceedingly rare.

Many questions remain unsolved regarding the etiology of this condition and relatively little animal experimentation has been done. Various authors have been able to produce a phlegmon of the stomach in dogs by inducing an acute alcoholic gastritis, rendering the stomach contents alkaline, and feeding streptococci. It is supposed that any chemical or mechanical injury to the gastric mucosa may be an underlying cause, but in

clinical practice we do not find this condition in cases of chronic irritation such as ulcer or carcinoma, nor is it consistently found in hypochlorhydria or achlorhydria. Therefore, although these factors may form some measure of predisposition, they cannot be considered as the chief underlying causes. Abuse of alcohol has been found consistently to be the main contributing cause of gastric phlegmon.

The lesion is most frequently localized in the pyloric portion. The pyloric canal shows concentric narrowing, the lumen often being quite narrow and irregular simulating the contraction seen in carcinoma. The gastric wall in the affected region is thickened and rigid, and no peristaltic waves pass through, resulting in considerable delay in emptying. Among the differential diagnoses to be considered are hyperplastic gastritis, cicatrix of healing ulcers, syphilitic infiltration with scarring, scirrhous carcinoma, sarcoma, lymphogranuloma, actinomycosis, and tuberculosis.

The acute condition is very seldom investigated by x-ray; it is usually considered as an "acute abdomen," and the diagnosis is made at operation. The subacute and the early and intermediate stages of chronic cases are brought for differential diagnosis by means of the x-ray. The end-results of late chronic stages with resulting sclerotic scarring are practically never differentiated from the end-results of other cicatricial conditions, as scarring from old chronic gastric ulcer, etc.

Clinically there are very few characteristic diagnostic signs and many cases lack a definite confirmation until operation or autopsy establishes the true nature of the condition. Subjective symptoms often consist merely of a tendency to nausea and vomiting and more or less severe epigastric pains. The objective findings are fever, palpable tumor in the epigastric area, spasm of the abdominal muscles, and weight loss, associated with leukocytosis and considerable malaise. Although the clinical features appear to indicate an inflammatory process, they do not differentiate between gastric phlegmon and acute or subacute ulcer, perforation, cholecystitis, or pancreatitis.

Two types of phlegmon are recognized: one involving the entire stomach or a large part of it, the other localized, either of the diffuse progressive type or the circumscribed stationary type.

The fully developed chronic form follows a very insidious course and progresses very slowly, often requiring several years. During the earlier stages ulceration is seldom found.

Diagnosis may be correctly established in most cases through the following factors:

(*a*) History of marked abuse of alcohol; (*b*) history of a prolonged complaint of vague gastric distress; (*c*) laboratory findings which suggest an inflammatory process but show normal or slightly low acid in the gastric contents, absence of lactic acid bacilli, normal blood sedimentation rate, and absence of occult blood in the stomach contents and stool; (*d*) findings on x-ray examination as described above, relatively unchanging over periods of months.

The rather marked discrepancy between the outstanding x-ray findings and the relative lack of confirmation of malignancy by laboratory methods appears to be a factor strongly contributing to the diagnosis of gastric phlegmon, especially when associated with a history of alcoholism.

Eight illustrations.

E. W. SPACKMAN, M.D.
Fort Worth, Texas

Pyloric Hypertrophy in the Adult. John Paul North and James H. Johnson, Jr. Ann. Surg. **131:** 316–329, March 1950.

Pyloric hypertrophy is commonly considered to occur in children, but the authors point out the importance of recognizing it in adults because it may simulate several serious gastric lesions and because it is amenable to surgical correction. Secondary pyloric hypertrophy is observed in both benign and malignant ulcers of the stomach, in association with gastric polyposis, and in hypertrophy of the gastric rugae. The authors, however, are concerned with what appears to be a primary hypertrophy. They have collected 59 cases from the literature, to which they add 5.

Primary pyloric hypertrophy may represent persistence of the infantile form. This view is supported by a life-long history of intermittent symptoms of pyloric disturbance in some cases. It has also been observed that roentgenologic abnormalities remain long after active symptoms have subsided in children. The majority of adult patients, however, first have symptoms between the ages of thirty-one and sixty, so that some cause other than persistence of infantile hypertrophy must be operative. Protracted pylorospasm and high carbohydrate diets have been suggested as causative agents.

Epigastric pain and vomiting are the most common symptoms. Eating aggravates the pain, and it is not susceptible to relief by antacids.

The roentgenologic features are elongation of the pyloric canal, irregularities of the mucosal folds, mushroom-shaped deformity of the base of the duodenal bulb, and 25 to 50 per cent gastric retention at the end of six hours. These findings persist even after antispasmodic drugs.

To recognize the lesion at the operating table the surgeon must do a gastrotomy and inspect the interior of the stomach. The pyloric ring should not be divided until after palpation.

Treatment depends on the severity of the symptoms. In some cases the lesion will so simulate carcinoma of the antrum that exploration is necessary. Pyloroplasty, gastric resection and gastro-enterostomy are satisfactory in cases requiring surgery.

Five illustrations, including 2 roentgenograms; 1 table giving details of the recorded cases.

ROBERT A. HAYS, M.D.
Cleveland Clinic Foundation

Generalized Giant Hypertrophic Gastritis Simulating Neoplasm: Differential Diagnosis and Report of a Case. Jay P. Bartlett and William E. Adams. Arch. Surg. **60:** 543–558, March 1950.

Total gastrectomy for benign lesions is rarely done. This report, therefore, is of special interest. It covers the case of a 42-year-old man with weight loss, bloating, dull epigastric aching, anorexia, and vomiting on one occasion. It had been his custom to drink half a pint of whiskey a week and two glasses of beer a day. No evidence of bleeding was found. X-rays of the stomach showed irregular polypoid protrusions and stiffening of the wall of the greater curvature. Gastroscopy showed a diffuse widening of all of the gastric folds suggestive of neoplasm. At operation the gastric walls were found to be thickened and nodes were present in the gastrohepatic omentum. Although frozen sections of the nodes were negative, the entire stomach was removed on the basis of the operative impression of

lymphosarcoma. The patient was cured and remained well except for one readily controlled bout of the "dumping syndrome"; he was followed for three years. The microscopic sections showed thickening of the rugae due to enlarged and tortuous glands with edema of the submucosa and thickening of the muscularis. The diagnosis was hypertrophic gastritis.

The author concludes by making the following six points in favor of total gastrectomy for generalized hypertrophic gastritis:

(1) The extreme difficulty of diagnosing this lesion by clinical, laboratory, x-ray, and gastroscopic examination; (2) the difficulty of reaching a diagnosis at operation, even with the aid of frozen section; (3) the probable premalignant nature of the condition; (4) the danger of fatal peritonitis from a break of the suture line when resection is not beyond the diseased area; (5) the possibility of dangerous hemorrhage, obstruction, or malnutrition under conservative medical management; (6) the lowered mortality and morbidity from gastrectomy.

Three roentgenograms; 1 photograph; 3 photomicrographs; 1 table. LEWIS G. JACOBS, M.D.
Oakland, Calif.

Prolapse of Gastric Mucosa and Its Possible Relationship with Peptic Ulcer and Upper Gastro-Intestinal Hemorrhage. S. P. Bralow, G. H. Becker, S. Scheinberg, and H. Necheles. Am. J. Digest. Dis. **17:** 65–69, March 1950.

The authors believe that the existence of a peptic ulcer and prolapse of the mucosa in the same case is not a coincidence, but follows a definite pattern. An ulcer causes an irritation of the gastric mucosa, hypertrophy occurs, and at times the hypertrophied rugal folds prolapse into the duodenum. They may cause pain similar to that of pyloric obstruction, and may also be the cause of upper gastro-intestinal hemorrhage.

Three cases of coexisting ulcer and prolapse are presented which were proved by operation; also two cases of severe hemorrhage secondary to prolapse of a fold of mucosa into the duodenum.

Five roentgenograms; 3 drawings.
JOSEPH T. DANZER, M.D.
Oil City, Penna.

Spot Film Technique in Roentgen Examination for Duodenal Ulcer. Arnold Bernstein. J. Canad. Assoc. Radiologists **1:** 8–11, March 1950.

The author believes that with spot-films and fluoroscopy the diagnostic reliability of examination of the duodenum should be almost 100 per cent, being more reliable than surgical exploration or even gross pathological examination. He compares the direct visualization of the inner surface of the gastro-intestinal tract by barium contrast with the study of the pathological specimen with the magnifying glass.

It is emphasized that the fluoroscopy must be done in all degrees of obliquity, "with flowing rotation" of the patient. The duodenum should be visualized in all degrees of (contrast) filling and at all possible angles. Also spot films should not be taken haphazardly but should be carefully controlled instantaneous films of the characteristic radiological appearances taken at diagnostically important moments. The pressure cone and manipulation by the examiner are other extremely important parts of the examination.

A combined fluoroscopic and radiographic study of the duodenum in various projections necessitates a three-dimensional interpretation of the radiographic images without which major errors are unavoidable. The ring recess at the base of the duodenal cap, if not identified as such, and the various other mucosal formations may produce appearances that will be mistaken for the crater of an ulcer.

Seventeen roentgenograms showing duodenal bulb deformities. E. KASH ROSE, M.D.
Louisville, Ky.

Primary Carcinoma of Duodenum. Jerome Kleinerman, Krikor Yardumian, and H. T. Tamaki. Ann. Int. Med. **32:** 451–465, March 1950.

Primary carcinoma of the duodenum has long been known as a rare condition, the reported incidence being 0.03 to 0.003 per cent of all autopsies. It constitutes approximately 45 per cent of primary carcinomas of the small intestine.

Primary duodenal carcinomas are subdivided anatomically on the basis of their origin from the suprapapillary, peripapillary, and infrapapillary portions of the duodenum. Peripapillary growths occur far more frequently than the other types. Occasionally, however, neoplasms which should properly be classified as tumors of the pancreatic and biliary systems arise from the ampulla of Vater, and the difficulty in making this distinction undoubtedly accounts in part for the high percentage of primary carcinomas reported in this portion of the duodenum. The first portion of the duodenum ranks second in order of frequency.

Carcinoma of the duodenum occurs in late middle and advanced life. It is more frequent in men than in women. Stenosing and polypoid lesions are most common. These infiltrate, ulcerate, and tend to encircle the lumen, often causing intestinal obstruction. Metastases occur infrequently. They usually involve the regional lymph nodes, mesentery, liver, and lungs.

The diagnosis of a primary malignant lesion of the duodenum is difficult. Roentgenography is the important procedure, though in both the authors' cases, diverticula of the duodenum were erroneously reported by the radiologist. Extraduodenal lesions causing extrinsic pressure defects and those lesions with complete obstruction of the duodenum cause the greatest trouble in establishing a definite diagnosis. Duodenal intubation and drainage may be an aid to diagnosis in a suspected case. In the differential diagnosis, cancer of the pylorus and in the first portion of the duodenum must be distinguished. If roentgen examination fails to demonstrate any gastric lesion but shows duodenal dilatation, the stomach as the site of the disease can be excluded.

Since metastases occur late, surgery may be of value even in well advanced cases. In the absence of metastases and complications, resection of the growth with secondary anastomosis has usually been done.

The course of the disease is short. The average duration of life after onset of symptoms has been given as five to nineteen months.

Two cases of primary suprapapillary adenocarcinoma of the duodenum are presented in detail, and the literature on all types of primary duodenal carcinoma is summarized, covering a total of 438 proved cases to date, of which 22.5 per cent were suprapapillary, 59.2 per cent peripapillary, and 18.3 per cent infrapapillary.

Six illustrations. STEPHEN N. TAGER, M.D.
Urbana, Ill.

Radiological Investigation of Intestinal Disorders in the Newborn. J. H. Middlemiss. Radiol. clin. **19:** 111–117, March 1950. (In English)

Five cases of intestinal obstruction in the newborn, either due to intestinal anomaly or to an acquired lesion, are reported. Four of the infants died. In all, however, the x-ray evidence was conclusive and provided data upon which a definite preoperative diagnosis could be made. It is thought that if the examination had been made earlier the outcome might have been different in at least some of the cases.

The author's technic is to take two roentgenograms of the abdomen in cases of suspected obstruction, one with the patient held erect and the other with the patient supine. The diagnosis is made on the interpretation of gas shadows in the bowel and is dependent upon the demonstration of (1) gaseous distention of the bowel proximal to the obstruction, (2) demonstration of fluid levels in the distended part of the bowel, indicating stasis, and (3) complete or almost complete absence of gas shadows from the bowel distal to the block. Studies have shown gas to be present in the stomach within a few minutes after birth and in the small intestine within a few hours; at three hours the ascending colon could be identified and at eight hours gas was widely dispersed in small and large bowel. The author believes, therefore, that at twelve or more hours after birth a useful roentgenologic opinion can be given in cases of suspected intestinal anomaly. X-ray examination may sometimes exclude the possibility of obstruction.

The oral administration of barium in suspected obstruction is to be avoided.

Nine roentgenograms.

Roentgenographic Demonstration of Ascaris Lumbricoides in the Intestinal Tract. Report of Case. Martin L. Tracey, Gerard O. Helden, and Hans J. Bruns. Gastroenterology **14:** 428–431, March 1950.

The clinical findings in Ascaris lumbricoides infestation of the intestines are non-specific. Vague abdominal discomfort, colicky epigastric pains, diarrhea, or peptic ulcer-like complaints may be present. The worm averages 25 to 30 mm. in length and may produce a longitudinal cylindrical filling defect demonstrable in the barium-filled bowel. Occasionally the alimentary tract of the worm is seen as a thread-like barium strand. This is best demonstrated after the barium has left that portion of the host's bowel. Identification is easier in the jejunum, where there is less overlapping and less filling of the bowel.

Two roentgenograms.

MORTIMER R. CAMIEL, M.D.
Brooklyn, N. Y.

Diverticulosis and Acute Diverticulitis of the Jejunum. Report of Two Cases. John W. Ratcliffe, Marshall K. Bartlett, and James A. Halsted. New England J. Med. **242:** 387–390, March 16, 1950.

Diverticulosis of the jejunum is uncommon and diverticulitis is apparently even more unusual. Acquired or false diverticula, with which the author is here concerned, are attributed to an out-pouching of the intestinal mucosa and the serosa of the bowel wall with an open ostium leading into the intestinal canal. These diverticula occur just off the mesenteric attachment, directly in line with the entrance of the mesenteric vessels.

There is no characteristic symptom or sign of a diverticulitis of the small bowel. Evidence of an acute inflammatory process within the abdomen may, however, lead to an exploratory operation, or possibly to the diagnosis of an appendicitis, or an investigation of the gastro-intestinal tract by x-ray. In this last instance, the small bowel frequently is not examined for diverticula. The pain and tenderness usually follow meals and there may be recurrent attacks on successive days, with periods of freedom from pain.

Complications consist of intestinal obstruction, hemorrhage, diverticulitis and rupture.

The authors' first patient was a 77-year-old female with history of repeated attacks of abdominal pain without any x-ray evidence of abnormality. She was admitted to the hospital with a white count of 15,600, abdominal pain, nausea, and vomiting. A diagnosis of appendicitis was made; the abdomen was opened and a loop of jejunum encountered showing numerous diverticula scattered over a distance of about 60 cm. One diverticulum appeared acutely inflamed but there was no evidence of perforation. Because of the extensive inflammatory reaction and the patient's age, resection was not done, but four months later she was again operated upon and the involved small bowel was successfully removed.

The second patient, a 36-year-old white female, experienced vomiting and crampy abdominal pains beginning after a heavy meal. There was spasm in the left flank anteriorly without localizing pain. The white count was 25,000. Exploratory laparotomy showed a mass in the left upper quadrant, consisting of the omentum adhering to the jejunum, where an inflamed diverticulum was encountered, which apparently had ruptured. A 9-cm. segment of bowel was resected. On the fifth postoperative day, intestinal obstruction developed and a short-circuiting operation was performed. The patient recovered but died the following year with a rapidly growing spongioblastoma multiforme. Postmortem, five diverticula measuring 2.5 cm. in diameter were encountered on the mesenteric aspect of the jejunum.

One roentgenogram; 1 photograph.

JOHN B. MCANENY, M.D.
Johnstown, Penna.

Thoracic Diverticula Which Originate from the Intestine. Robert E. Gross, Edward B. D. Neuhauser, and Luther A. Longino. Ann. Surg. **131:** 363–375, March 1950.

A congenital anomaly which consists of a long thin diverticulum arising from the duodenum or jejunum, penetrating the right side of the diaphragm, is reported. This anomaly was observed in three children, and detailed histories of the cases are presented.

The diverticula extended upward in an extrapleural location, usually in the posterior part of the chest, assuming various forms after entering the thoracic cavity. The walls contained smooth muscle and the mucosa resembled that of the stomach in two cases and of the jejunum in one case.

The symptoms are due to the accumulation of gas and fluid in the thoracic portion of the diverticulum and also to hemorrhage from ulceration caused by the secretion of pepsin and hydrochloric acid by the mucosa.

The roentgenologic appearance varies but usually air-filled loops can be seen due to the coiled diverticulum if films are made in an upright position. A mass extending

out from the mediastinum, usually to the right, was seen in all three cases. Barium by mouth can not be expected to pass into the diverticulum in most instances.

A multiple-stage approach is often required because of the long and devious course of the diverticulum.

Four roentgenograms; 4 drawings.

ROBERT A. HAYS, M.D.
Cleveland Clinic Foundation

Significance of the Intestinal Polypoid Lesion. Harry M. Weber. J. A. M. A. **142:** 693–697, March 11, 1950.

The polypoid lesion of the colon is important, since from it almost all carcinomas of the colon originate. Its early recognition and prompt removal are thus of first importance in improving the treatment of intestinal carcinoma.

The author refers to any lesion intruding itself into the lumen of the colon as polypoid, whether benign or malignant. While the histology is important, recognition of the existence of such a lesion is more important, since the great majority are malignant.

Polypoid lesions develop from cells present in the intestine at birth or before, but the factors which control proliferation are unknown. Size, rate of growth, and type of spread vary widely. The four cases reviewed in this article demonstrate how carcinoma evolved from polypoid lesions, some of which were as small as 1 cm. in diameter. In one case, sixteen years elapsed from the time the polypoid tumor was first seen to the time frank carcinoma was recognized.

In those lesions which can be reached by the examining finger or the sigmoidoscope, the barium enema is inferior as a diagnostic method to sigmoidoscopy. In lesions beyond the reach of the sigmoidoscope, the barium study is the only reliable source of information. The symptoms which should be followed by investigation of the intestine are: blood in the stools or secondary anemia; colicky, crampy abdominal pain; persistent alteration of intestinal activity; an abdominal mass.

Fourteen roentgenograms.

CORNELIUS COLANGELO, M.D.
Chicago, Ill.

Endometriosis of the Large Bowel Treated with Testosterone. Richard H. Marshak and A. I. Friedman. Gastroenterology **14:** 576–579, April 1950.

A preoperative diagnosis of endometriosis of the large bowel is important, since the institution of conservative therapy will, in some instances, result in a subsidence of symptoms.

According to many authors, there are no characteristic roentgen findings in colonic endometriosis and many patients with this lesion have been subjected to a two-stage abdominoperineal resection of the rectosigmoid where the preoperative and operative diagnoses were carcinoma. Others have described, in a number of cases, a characteristic lesion consisting in a long constant filling defect with sharp, irregular borders, intact mucosa, and fixation of the bowel, with tenderness on palpation. The authors believe that when these findings are present in a female, a fairly exact preoperative diagnosis of endometriosis can be made.

One case report is presented. Diagnosis was by x-ray, and treatment by androgenic hormone, with a complete relief of symptoms and resolution of the lesion as seen roentgenologically.

Two roentgenograms.

DANIEL WILNER, M.D.
Atlantic City, N. J.

Comparative Study of Cystic Fibrosis of the Pancreas and Chronic Calcareous Pancreatitis. Three Case Reports of Calcareous Pancreatitis. Julius Solovay and H. U. Solovay. Gastroenterology **14:** 509–521, April 1950.

The author presents a case of unusual interest dealing with a middle-aged white male with chronic calcareous pancreatitis who died of purulent bronchitis and multiple lung abscesses. The striking similarity to cystic fibrosis of the pancreas of infancy and childhood, in which respiratory symptoms develop soon after pancreatic deficiency, and in which death is usually due to respiratory infection, is obvious. With this in mind, an investigation was made of all the available case reports of pancreatic lithiasis and calcification to determine whether severe respiratory infection was the exception or the rule, and whether it was the usual cause of death, as in cystic fibrosis.

In a total of 214 cases with 51 deaths, there were 4 cases of non-fatal respiratory infection and 3 of fatal pulmonary suppuration. Fourteen patients died of tuberculosis, and 2 had mild forms of that disease. Eleven patients died of direct complications of the pancreatic disease, such as diabetes, carcinoma of the pancreas, septicemia, etc. There were 3 deaths from cirrhosis of the liver. In 19 of 102 surgical cases, death occurred in the immediate postoperative period.

The following conclusion is drawn; Pyogenic respiratory infection is not important in adult chronic pancreatitis with calcification, possibly because deficiency of external pancreatic secretion is rarely complete in these cases.

Seven roentgenograms; 1 table.

DANIEL WILNER, M.D.
Atlantic City, N. J.

The Appendix: A Study Comparing Radiological Diagnosis with Operative, Anatomical and Pathological Findings and Subsequent Clinical Results. L. P. Belisle. J. Canad. Assoc. Radiologists **1:** 16–18, March 1950.

The author made a follow-up study of 193 patients who had had varied x-ray findings indicative of appendicitis and found that 74, or 38 per cent, had had appendectomies and that 47 per cent of the remainder were still unimproved.

In a general discussion, he lists three objections to roentgen examination: (1) that the appendix so frequently presents anomalies that variations of anatomy cannot be interpreted with any degree of consistency; (2) that the physiology of the appendix is not known, making difficult the interpretation of slight functional changes; (3) that roentgen examinations delay early surgery and are therefore detrimental.

In spite of these objections the author believes that his observations point to the value of roentgen studies in diagnosing appendicitis. He summarizes the results of his study as follows:

"(1) Visibility or invisibility of the appendix is irrelevant to disease of the appendix.

"(2) Painful fixations of the appendix are almost always evidence of disease; likewise a prolonged stasis of

barium in the appendix without evidence of stasis of barium in the colon.

"(3) Definite and constant narrowings of the caliber of the appendix almost constantly refer to kinks and adhesions; sometimes they mean a diffuse neurogenic infiltration, but, as a rule, clinical results are not satisfactory in these latter cases.

"(4) The upright retrocecal appendix or the abnormally long appendix would seem to indicate disease of the appendix, since all our patients of this category have been cured by operation.

"(5) Pain referred to the umbilicus or the epigastrium on palpation of the appendix seems to be difficult of interpretation without a definite relation to an observed condition of the appendix.

"(6) The clinical end results based on the so-called roentgen signs would seem to compare favorably with surgical statistics." E. KASH ROSE, M.D.
Louisville, Ky.

Radiologic Diagnosis of Complications of Biliary Lithiasis. Lidio G. Mosca. Prensa méd. argent. **37:** 485–493, March 10, 1950. (In Spanish)

The author classifies the complications of biliary lithiasis susceptible of radiologic detection under five heads:

(*a*) *Adhesions of the gallbladder.* Differentiation between congenital deformity of the gallbladder and acquired deformity as a result of adhesions is often difficult. The congenitally deformed gallbladder frequently contains gallstones. The diagnosis is best made by simultaneous opacification of the gallbladder and the digestive tube. The patient is examined in various positions and a fat meal is used in order to exaggerate the existing gallbladder deformity.

(*b*) *Epiploitis.* This may appear as perivisceral abdominal adhesions of the type called epiplopericolitis. The inflammatory omental process may be secondary to surgical trauma, foreign bodies (gallstones), or such inflammatory conditions as cholecystitis, colitis, or appendicitis. Sometimes the inflamed omentum may give rise to tumor-like masses. The extent of the defect of epiploitis is greater than that seen with carcinoma; so that one may find discrepancies between the radiologic findings and the palpable tumor. Briefly, the fundamental radiologic signs of epipericolitis are colonic stenosis with apparent destruction of the mucosa, which is found to be preserved on examination with the opaque enema, and gradual transition of the image from the pathologic to the normal colon, with regular borders. There is a fundamental difference between the filling defects shown by the oral and by the enema method.

(*c*) *Pyloroduodenal stenosis* by biliary stone. Differentiation must be made between pyloroduodenal stenosis due to ulcer, carcinoma, and biliary lithiasis. The stenosis may appear in three stages: first stage, hyperperistalsis; second stage, loss of muscular contractile function, atony and gastric retention; third stage, gastrectasia.

(*d*) *Internal biliary fistulas* are diagnosed by air in the biliary tree; opacification of the gallbladder or biliary passages; negative cholecystography (that is, no shadow of the gallbladder); level of fluid in the gallbladder; air or barium surrounding a biliary calculus; insufflation or opaque filling of the colon (direct cholecystocolonic fistula); persistence of the opaque filling.

(*e*) *Biliary ileus.* The radiologic triad of biliary ileus consists of (1) direct visualization of the biliary calculus in the intestinal lumen, (2) dilatation of the jejunal loops, giving typical aspect of intestinal obstruction, (3) demonstration of opaque stones in the extrahepatic biliary passages, that is, internal biliary fistulas.

Fourteen roentgenograms. JAMES T. CASE, M.D.
Chicago, Ill.

Surgical Significance of the Nonvisualizing Gallbladder. R. Bruce Henley and Edwin G. Clausen. West. J. Surg. **58:** 107–109, March 1950.

Failure to demonstrate the gallbladder roentgenologically when not accounted for by factors known to interfere with visualization has been proved to denote disease of the gallbladder in from 90 to 99 per cent of reported cases. The authors discuss the factors which must be considered and correctly interpreted before one can state that the gallbladder is diseased. Once that fact can be unequivocally determined, surgical advice can be given with confidence.

A majority of radiologists believe that the results of cholecystography with oral administration of priodax are as accurate as those produced by intravenous injections of the dye. The oral double dose or reinforced method has proved to be of distinct value, resulting in an increase of approximately 10 per cent greater visualization. The intravenous method, however, is advantageous in instances in which there is interference with absorption from the gastro-intestinal tract.

Regardless of the method employed, the dye must enter the blood stream, the liver must be functioning properly, the gallbladder must be receptive, and technical aspects must be adequate to insure visualization.

It is a well known fact that marked impairment of liver function will result in failure of priodax to pass through the liver. The gallbladder may fail to visualize also during an attack of acute pancreatitis or in the presence of an acute duodenal ulcer. Spastic conditions of the gastro-intestinal tract, especially the colon, may likewise account for failure of visualization. In the biliary tract itself obstruction in the cystic duct or pathological changes in the mucosa of the gallbladder may prevent the entrance of the dye or inhibit the ability to concentrate it. Occasionally the reason for non-visualization of the normal gallbladder cannot be determined, as the authors illustrate by a case report.

A film of the entire abdomen is necessary if the rare instance of situs inversus is to be detected. Premature evacuation of the dye will result in an apparent failure to visualize. This may be due to improper instructions or failure of the patient to comply with instructions.

DANIEL WILNER, M.D.
Atlantic City, N. J.

HERNIA

A Study of Hiatus Hernia. A. X. Rossien, J. R. Reuling, and A. Stanton. Am. J. Digest. Dis. **17:** 69–76, March 1950.

Hiatus hernia is a term used to describe a herniation of the stomach and rarely of the colon through the esophageal hiatus. It is of two types: true, where the hernia has its own peritoneal covering, and false, where it has a covering of surrounding structures or inflammatory tissue.

The cause of these hernias is a weakness of the muscle fibers surrounding the esophageal hiatus. When increased abdominal pressure occurs, due to vomiting,

coughing, etc., the herniation may become so large that the entire stomach may be above the diaphragm (upside-down stomach).

The cause of the weakness of the muscles around the hiatus is not known. One theory is that the stomach is slow in descending to its normal position and the hiatus must necessarily stay large to permit its descent.

Hiatus hernias are usually found, or at least give symptoms, after the fourth decade of life. It is believed that the tendency to hernia was present during earlier life and that the general tendency to muscle fiber weakness causes its occurrence after that time.

The symptoms depend on whether or not the hernias are transitory or have become incarcerated and are in direct proportion to the degree of vagus stimulation. They may simulate peptic ulcer or gallbladder disease, and pain in the chest, radiating down the left arm, as in angina pectoris, is not uncommon.

Hemorrhage is many times a complicating factor. It may be severe or may be of the slow, oozing type causing hyperchromic anemia. Ulcers are frequently present and may be caused by the pressure of the muscle of the hernia against the stomach. Ulcers of the esophagus also occur secondary to regurgitation of the acid content.

The diagnosis is always made by x-ray, which will reveal the size of the hernia, whether or not it is fixed, and whether or not ulceration of the esophagus or stomach has occurred. Hiatus hernias may be transitory, and several studies may be required for their demonstration.

Medical treatment is usually indicated—antispasmodics, bland diet, etc. Surgical treatment consists in phrenicotomy for palliation, repair of the diaphragmatic defect, or vagotomy in the presence of an associated ulcer.

Details of 13 cases are presented, of which 10 were in women.

Ten roentgenograms; 1 table.

JOSEPH T. DANZER, M.D.
Oil City, Penna.

Two Cases of Intra-Thoracic Kidney. Walter F. Bugden. Dis. of Chest **17:** 357–359, March 1950.

The author gives the histories of two cases of diaphragmatic hernia. The first patient, a 16-year-old male, received an injury to his right lower chest and flank in an automobile accident. A roentgenogram of the chest revealed a mass in the right posterior mediastinum, which on surgery proved to be a herniated kidney. The kidney was replaced and the defect in the diaphragm closed.

The second case was discovered on a routine chest examination. A mass in the left posterior mediastinum was proved by intravenous urography to be a kidney. The hernia was repaired and the kidney replaced.

The author believes that left-sided hernias should be repaired, in order to avoid the possibility of intraperitoneal viscera being herniated into the chest.

Five roentgenograms. HENRY K. TAYLOR, M.D.
New York, N. Y.

THE MUSCULOSKELETAL SYSTEM

Acro-Osteolysis, a New Disease Picture. Hans Harnasch. Fortschr. a. d. Geb. d. Röntgenstrahlen **72:** 352–359, January 1950. (In German)

The author has observed a case of an apparently new type of destructive bone lesion which he calls acro-osteolysis. The x-ray findings are: bilateral defects in the distal phalanges of the fingers, consisting of destruction of large portions of the shafts and bases of the bones; absence of associated reactive bone changes and periosteal thickening, and preservation of the fingernails; bilateral symmetrical destructive changes at the metatarsal phalangeal joints of the big toes with periosteal reaction; similar defects in some of the other toe bones of both feet, without periosteal or bony reaction; extensive destruction of the alveolar processes of both upper and lower jaws; an inflammatory process in the cervical spine (fifth and sixth bodies) with questionable healing; moderate kyphoscoliosis of the lower cervical and upper dorsal spine.

Various other conditions to be possibly considered in the differential diagnosis, such as leprosy, arthritis mutilans, ainhum, and various congenital osteolytic and inflammatory conditions, syringomyelia, etc., could be ruled out with reasonable certainty.

The author regards these changes as probably of central nervous origin and due to an abnormality of balance between the sympathetic and parasympathetic systems, wherein increased sympathetic activity stimulates the osteolytic process. He postulates that this may be an influence from overactivity of the eosinophilic cells of the pituitary.

The case of a man of 43 with no family history of any bone disease is presented. The patient discontinued his work as a locksmith because of recurring attacks of eczema involving the hands, feet, arms, and legs, apparently due to handling of oils and tar. The condition then completely disappeared, but later, recurred when the original occupation was resumed.

The fingers had gradually become shorter and thicker over a period of many years. No pain was present but recently there had been more or less numbness of the fingers and toes. There was unusual mobility of the terminal phalanges in all directions. Slight prognathism was also present. X-ray findings were consistent with the summary given above.

In 1949 (three years later), the patient was again seen complaining of pain in the shoulders. Similar destructive lesions were observed, on x-ray examination, in the acromial ends of the clavicles bilaterally. Studies of the hands and feet at this time showed some measure of increased destructive changes.

Seven illustrations. E. W. SPACKMAN, M.D.
Fort Worth, Texas

Hypervitaminosis A. Charles T. Fried and Milton J. H. Grand. Am. J. Dis. Child. **79:** 475–486, March 1950.

Hypervitaminosis A is a clinical entity which occurs in late infancy and early childhood. The pathologic processes are the result of a prolonged and excessive intake of vitamin A and a derangement of vitamin A metabolism. Clinically, the condition is manifested by anorexia, with loss of weight, extreme irritability and fretfulness, low-grade fever, pruriginous rash, sparseness of hair, hepatomegaly, and exquisite pain on pressure over the long bones. Biochemically there are abnormally high vitamin A levels in the blood serum and increased level of the serum lipids. Roentgenographically, the changes in the long bones are distinctive, characterized especially by periosteal proliferation.

A review of the literature uncovered a significant scarcity of reported cases of hypervitaminosis A. The

authors add two new cases. The excessive use of cod-liver oil and its concentrates and the paucity of reports on any of these harmful effects on human beings may be responsible for the generally accepted opinion that routine administration of cod-liver oil in high doses is harmless. This concept will have to be altered in view of the mounting evidence to the contrary. There is little doubt that many more human instances of hypervitaminosis A will appear in the literature in the near future. The awareness of the existence of this syndrome will greatly contribute to its early recognition.

The primary organ concerned with vitamin A metabolism is the liver. Its capacity to store the vitamin is enormous and it can maintain 95 per cent of the total vitamin A reserve. This storage in the liver is considered harmless. However, any amount which overwhelms the capacity of the liver to remove vitamin A from the blood is considered harmful. Clinically, all the reported cases of this disease disclose hepatomegaly. The clinical laboratory data indicate no consistent findings of hepatic dysfunction.

Radiographic examination of the long bones in one of the authors' two cases disclosed periosteal thickening involving the shafts of the right and left ulnas at the midportion for about 2.0 cm. The thickening gradually tapered off toward the ends of the bones. There was lateral bowing of the shafts of the lower extremities with widening of the ends of the bones and slight sclerosis. The epiphyses were irregular in outline. Roentgenographic examination in the second case showed periosteal thickening involving the middle thirds of the shafts of both tibias, the left ulna, and the lower part of the right ulna. In both cases there was gradual recovery after withholding of the vitamin.

Three roentgenograms; 2 charts.

HUGH A. O'NEILL, M.D.
Cleveland, Ohio

Chronic Poisoning Due to Excess of Vitamin A. Description of the Clinical and Roentgen Manifestations in Seven Infants and Young Children. John Caffey. Pediatrics **5:** 672–688, April 1950.

Seven cases of chronic poisoning in infants and young children due to the ingestion of excessive quantities of vitamin A and vitamin concentrates A and D are reported. The toxic manifestations probably are due to the vitamin A content of these latter concentrates. In all cases there was a latent period of several months between the start of excessive dosage and the appearance of diagnostic clinical signs. The first symptoms may be pruritus and anorexia followed by tender swellings, hyperirritability, and limitation of motion. The tender swellings were most common in the forearms and were attached to underlying structures, apparently the bones.

Roentgenograms revealed cortical hyperostoses in two or more bones of every patient. All of the 14 ulnas in the 7 patients were affected and in every patient one or more of the metatarsals were thickened. The mandibles and scapulas were normal in every instance. Early, the hyperostoses have a shell-like appearance, with a zone of diminished density between the subperiosteal thin layer of bone and the external surface of the old cortex. After the withdrawal of vitamin A, this intermediate clear zone disappears; the hyperostosis then shrinks onto the old cortex and fuses with it.

Cortical hyperostoses due to excessive intake of vitamin A may be differentiated from infantile cortical hyperostosis by the following features: (1) Infantile cortical hyperostosis always has made its appearance in the first four months of life, while hypervitaminosis A has not been recognized before twelve months of age. (2) The face and jaw have been involved in every case of infantile cortical hyperostosis, but have not been affected in any cases of hypervitaminosis A. (3) The metatarsal bones frequently are involved in vitamin A poisoning and rarely in infantile cortical hyperostosis. (4) The blood vitamin A content is increased in hypervitaminosis A. (5) Fever is the rule in infantile cortical hyperostosis but is absent in hypervitaminosis A. (6) Recovery from vitamin A poisoning is rapid after stoppage of ingestion of excessive vitamin A, in contrast to the slow recovery in infantile cortical hyperostosis. (7) Scapular lesions are unknown in vitamin A poisoning but have been present in several cases of infantile cortical hyperostosis.

Eighteen roentgenograms; 2 photographs; 1 drawing.

HOWARD L. STEINBACH, M.D.
University of California

Infantile Cortical Hyperostoses (Caffey-Smyth Syndrome). Nathan Goluboff. Canad. M. A. J. **62:** 189–191, February 1950.

A case of infantile cortical hyperostoses, in an infant of four and a half months, is reported, with the typical findings of swellings of the face and cortical hyperostoses of mandibles, femurs, humeri, and ribs. Other common findings present were marked irritability, elevated sedimentation rate, and increased blood phosphatase.

Four roentgenograms.

Fluorosis, with Report of an Advanced Case. Leslie G. Kilborn, T. S. Outerbridge, and Hai-Peng Lei. Canad. M. A. J. **62:** 135–141, February 1950.

In 1934 the senior author traveled to Kwechow Province of Southwest China to pursue an anthropological study. There he found arthritis and joint ankylosis in a majority of the adults in certain small villages of the Miao race. The physical appearance of the arthritic Miao corresponded closely to the published photographs of the Danish cryolite workers afflicted with fluorosis (Roholm: Fluorine Intoxication, London, H. K. Lewis, 1937). The fluorine concentration in the drinking supply of the affected Miao villages was found to be 6.28 and 5.93 parts per million.

The usual clinical onset of the disease was at about ten years of age. In acute cases death occurred at about eighteen years, but if the disease became chronic the patient often lived to be fifty. Pigs were also affected because they shared human drinking sources. All other domestic animals were unaffected, since they drank pond water, which contained no fluorine.

No living patients have been persuaded to present themselves at a hospital for clinical study, but the authors describe the study, one year after death, of a skeleton of an affected male who died at the age of thirty-seven. All bones were markedly thickened, porous, rough, and brittle. There was complete ossification of the intervertebral disks, with fusion of the vertebrae, making the spine one long rigid bone.

Roentgenograms of the bones revealed increase in density, thickening of the trabeculae, and narrowing of marrow cavities. There may have been some rarefaction near the ends of the long bones. The findings suggest that in human subjects osteoporosis and osteosclerosis occur, but that the latter process predominates.

No histologic studies have yet been made on the bones.

Chemical studies showed about twenty times the normal fluorine content for many of the bones examined, with an even higher ratio for teeth.

Eight illustrations including 3 roentgenograms; 2 tables.

T. F. WEILAND, M.D.
Jefferson Medical College

Skeletal Changes in the Manner of Cretinism after Thyroidectomy in Childhood. Otto-Hans Kahler and Hans von Braunbehrens. Fortschr. a. d. Geb. d. Röntgenstrahlen **72:** 190–196, December 1949. (In German)

A 49-year old woman who had undergone a goiter operation at the age of eleven years showed skeletal changes typical of those in cretinic skulls: shortening of the metacarpals and metatarsals, flattening of the vertebral bodies, and extensive disturbances of epiphyseal ossification. Osteochondritis dissecans in the region of the medial femoral condyle was also observed. The patient's growth had been normal until the time of operation; her final height was 140 cm. Menstruation appeared at the age of twenty-five years and was regular. Since the age of twenty years the patient had complained of pains in different joints. These pains had become worse and were the cause for her hospitalization.

Five roentgenograms; 1 photograph.

ERNST A. SCHMIDT, M.D.
Denver, Colo.

Contribution to the Study of Sheathing Periostosis. C. M. Gros, Voegtlin, Fruhling and Speeg. J. de radiol. et d'électrol. **31:** 153–159, 1950. (In French)

A case is presented in which Hodgkin's disease of the mediastinal nodes was accompanied by a generalized periosteal thickening. The bone condition developed fully in four months. It differed from the state described in hypertrophic pulmonary osteoarthropathy in the absence of clubbed fingers and lack of noticeable change in the articular and juxta-articular areas. The periosteal thickening was more pronounced in the center of the diaphyses and became progressively thinner as the epiphyses were approached.

Microscopic study revealed normal periosteal tissue, but within the periosteum there was a layer of necrotic bone. Attention is drawn to the inaccuracy of the term periostosis or periostitis, since the condition is in reality a sheathing dysostosis.

CHARLES NICE, M.D.
University of Minnesota

Aneurysmal Bone Cyst: A Pathological Entity Commonly Mistaken for Giant-Cell Tumor and Occasionally for Hemangioma and Osteogenic Sarcoma. Louis Lichtenstein. Cancer **3:** 279–289, March 1950.

This paper deals with a distinctive lesion of bone that constitutes a fairly common pathologic entity but nevertheless seems not to be generally recognized as such. It is essentially a solitary, localized, and expanded fibrous process honeycombed by an enormously dilated, plexiform vascular bed. It characteristically produces a prominent bulging of the bone, eroding and destroying the overlying cortex, though tending to be delimited peripherally by a thin shell of periosteal new bone. In the interior of the lesion there is complete replacement of the normal architecture by a peculiar cavernous fibrovascular tissue. Numerous pools of blood are contained within what seem to be dilated, preformed vascular channels, bordered directly by supporting connective tissue. The latter shows hemorrhage, giant-cell reaction, and reparative new-bone formation.

The lesion is encountered in the vertebral column, in the flat bones, and in the shafts of the long bones. The affected bone area, irrespective of location, is characteristically more or less expanded, appearing cystically transformed and often ballooned-out to a striking degree. In long bones particularly, the expanding lesion tends to push out eccentrically, as giant-cell tumor seldom does, and to involve internally only part of the width of the bone. In flat bones, on the other hand, the entire width of the affected bone area may be transformed, resulting in a rather symmetrical fusiform expansion. The contour of the bulging lesion is roughly ovoid, and its long axis is in the direction of the bone within which it arises. A lesion within a vertebral arch may measure no more than 2 to 3 cm. in length, whereas one in a femur may be as large as 7 cm. or more in greatest dimension.

The shell of periosteal new bone defining the lesion peripherally may appear defective in places, in which case it may be rather faintly outlined, although its rounded contour is still discernible. The roentgenographic projection of the interior of the cyst appears relatively radiolucent, indistinctly mottled, and often delicately or coarsely trabeculated.

Aneurysmal bone cyst is entirely benign and responds satisfactorily to simple curettement and apparently also to radiation therapy.

Five roentgenograms; 8 photomicrographs.

DONALD S. CHILDS, JR., M.D.
The Mayo Clinic

A Re-evaluation of Solitary Plasma-Cell Myeloma of Bone. William M. Christopherson and A. J. Miller. Cancer **3:** 240–252, March 1950.

The authors present a critical review of 94 cases of solitary plasma-cell myeloma of bone recorded in the literature between 1897 and 1949, and present 3 cases of their own. Lesions were considered as solitary if they had been followed for at least three years without dissemination or if an autopsy had been performed and a single lesion was found. The vertebrae proved to be the most common location of the tumor, with the femur and pelvis following in that order. Radiographically there appeared to be two types of lesion, the first presenting the appearance of a giant-cell tumor and the second being purely destructive and commonly of intramedullary location. The majority of the latter group suggested metastatic carcinoma.

The authors discuss thoroughly the points for and against a solitary myeloma being a stage in the development of multiple myeloma. They conclude that solitary plasma-cell myeloma of bone appears to be a well established entity, unrelated to multiple myeloma. The neoplastic nature of plasma-cell myeloma of bone is suggested by its unicellular composition. The natural history of the lesion, however, casts some doubt upon this concept.

Diagnosis depends on roentgenographic bone surveys, bone-marrow examination, clinical evaluation, and a prolonged period of observation. The prognosis of true solitary myelomas of bone is always favorable.

Six photomicrographs; 5 tables.

DONALD S. CHILDS, JR., M.D.
The Mayo Clinic

Ruptured Cervical Intervertebral Discs. C. Hunter Shelden and Robert H. Pudenz. California Med. **72:** 156–158, March 1950.

The problem of ruptured intervertebral disks in the cervical region differs from that in the lumbar area because in the former the symptoms may be due to involvement of the spinal cord or the nerve roots, or both. The most frequent sites of rupture are between the fifth and sixth and the sixth and seventh cervical vertebrae.

Symptoms of recurrent stiffness and pain in the neck, of short duration, occur. Attacks tend to become more frequent, with extension of pain into the shoulder and, later, the arm and forearm.

Roentgenograms of the cervical spine should be taken routinely. The author believes that they should include oblique views and a projection through the mouth in addition to anteroposterior and lateral views. Roentgen findings include the loss of the cervical curve, a point of localized narrowing of the intervertebral disk and hypertrophic changes of the adjacent vertebrae. Myelography has proved to be of great value, but it should be considered as a method for accurate localization of the lesion and not employed to replace clinical diagnostic procedures.

Treatment is discussed briefly.

HOWARD L. STEINBACH, M.D.
University of California

Osteomyelitis of the Long Bones Caused by Friedländer's Bacillus. Cecil Komins, S. Skapinker, and Sholem Kay. Brit. J. Radiol. **23:** 168–171, March 1950.

Osteomyelitis of the flat bones due to Friedländer's bacillus is not uncommon secondary to otitis media and septicemia, but osteomyelitis of the long bones of similar origin has not previously been reported in the literature. Two such cases are presented, one secondary to pneumonitis and one to prostatitis caused by Friedländer's bacillus. A third case following pulmonary infection is briefly mentioned.

Both of the authors' patients showed minute honeycomb-like cortical destruction without osteosclerosis. Periosteal elevation and proliferation occurred late.

SYDNEY J. HAWLEY, M.D.
Seattle, Wash.

Pachydermia with Wrinkling, Associated with Hypertrophic Pachyperiostitis of the Long Bones; Its Occurrence in Broncho-Pulmonary Cancer. Mariano R. Castex, Egidio S. Mazzei, and Fidel Schaposnik. Prensa méd. argent. **36:** 119–131, Jan. 21, 1949. (In Spanish)

Contributions and investigations of recent years have permitted the differentiation of a special condition of great clinical interest in the lesion known as cutis verticis gyrata, "bull dog scalp," or "wrinkled pachydermia," and the discovery that there may be a relation between this condition and bronchopulmonary cancer. The association of cutis verticis gyrata with osteoperiosteal lesions of the extremities has been recognized under the name "osteodermopathia hypertrophica." Touraine in 1891 described a case of this sort. Labbé and Renault in 1926 wrote on this lesion under the term "osteodermopathia hypertrophiante," the patient exhibiting a facial aspect with deep transverse wrinkling of the skin of the forehead and much thickening of the epidermis and dermis.

The syndrome described by the authors, known since the early days of radiology, consists of cutaneous and osseous characteristics, affecting usually young adults between twenty and forty years of age. Women are included in the authors' material. The lesion is of insidious beginning and slow development, including discrete articular pains, diminution of capacity for work, and progressing enlargement of the hands and feet, until finally the clinical picture is clear. This includes: cutis verticis gyrata; peculiar severe and old-looking facial aspect, actually simulating leprosy in some instances. The palms are likely to be involved, but not the soles. The fingers are thickened and the nails convex. The long bones are enlarged but without elongation, especially the fingers, the lower third of the forearm, and the lower two thirds of the leg. Radiologically there is hyperplasia of the periosteum affecting especially the radius and the ulna. Contrary to what is found with pulmonary osteoarthropathy, the metacarpals and metatarsals are rarely involved. Acromegaly may be confounded with this lesion, which is sometimes called "pseudacromegaly." Enlargement of the sella, however, is lacking.

In the authors' case, there was a bronchogenic carcinoma. Search of the literature revealed a similar case reported by Fried (Arch. Int. Med. **72:** 565, 1943).

Thirteen roentgenograms; 6 photographs; 4 photomicrographs.

JAMES T. CASE, M.D.
Chicago, Ill.

Osteoporotic "Cough Fractures" of the Ribs. G. Zur. Fortschr. a. d. Geb. d. Röntgenstrahlen **72:** 144–153, December 1949. (In German)

In cases of long-continued violent cough, fractures of the ribs can occur which may be compared to march fractures, to the spinous process fractures in earth shovelers, and to other so-called "fatigue" fractures, as far as type of lesion and mode of onset are concerned. Primary osteoporosis due to different causes (avitaminosis, pulmonary disease, etc.) is a predisposing factor. The patient may be entirely unaware of a fracture, and the fractures may heal practically without symptoms. The impression of pseudarthrotic healing which is occasionally suggested by roentgenograms is not confirmed by histologic examinations. Six cases are reported.

Six roentgenograms.

ERNST A. SCHMIDT, M.D.
Denver, Colo.

Humeral Head Defect in Recurrent Anterior Dislocation of the Shoulder. J. Crawford Adams. Brit. J. Radiol. **23:** 151–156, March 1950.

Patients suffering from recurrent dislocation of the shoulder show a defect in the head of the humerus in films made in anteroposterior projection with the flexed forearm internally rotated to an angle of 60 degrees from the sagittal plane. It is not usually seen in other views. It is presumably the result of the trauma causing the original dislocation and is probably a contributing factor in recurrences.

Eight illustrations, including 6 roentgenograms.

SYDNEY J. HAWLEY, M.D.
Seattle, Wash.

The Os Centrale Carpi. Theo Marti. Schweiz. med. Wchnschr. **80:** 280–281, March 18, 1950. (In German)

Anomalies and accessory osseous elements may lead

to slow healing following minor trauma or may even be painful spontaneously. In the wrist one of the common anomalies is the os centrale, which lies between the navicular, the capitate, and the lesser multangular. Three stages can be distinguished: (1) a separate ossicle sharply demarcated from the navicular; (2) an element fused with the navicular, which then has a more or less "humpbacked" contour; (3) an accessory element not sharply demarcated, with cystic degeneration or cartilaginous inclusions. A case of each type is illustrated by very poorly reproduced roentgenograms.

LEWIS G. JACOBS, M.D.
Oakland, Calif.

Calcaneal Epiphysitis: A False Conception. Giuseppe Toniolo. Radiol. clin. **19:** 81–94, March 1950. (In Italian)

The author is impressed with the difficulty of differentiating normal calcaneal epiphyses from those presenting the radiological signs attributed to epiphysitis. He mentions the work of Franchi who, after studying 60 normal children at various stages of growth, was able to show in many of them the known radiological signs of epiphysitis. The author himself studied 200 roentgenograms of the os calcis and was able to demonstrate that the so-called calcaneal epiphysis is in fact always surrounded by the fibers of the tendon of Achilles. This was also confirmed by histologic studies.

On the basis of these findings, it is stated that the shadow seen posterior to the os calcis is due to a sesamoid and not to an epiphysis and that the entity known as calcaneal epiphysitis is therefore not existent. In view of this, further investigations will be necessary to explain the painful heel of growing children.

Five roentgenograms; 3 photomicrographs.

CESARE GIANTURCO, M.D.
Urbana, Ill.

Osteitis Pubis. With Five Case Reports. D. St. Clair L. Henderson. Brit. J. Urol. **22:** 30–51, March 1950.

Five cases of osteitis pubis are reported. Four of the cases followed retropubic prostatectomy and one suprapubic prostatectomy preceded by perforation of the bladder during preliminary cystoscopy. The author believes that, if the condition is borne in mind, the diagnosis should offer no difficulty, and x-ray studies will differentiate it from metastatic tumor deposits.

The roentgen findings, which lag behind the clinical manifestations, have been described by various authors, including Lazarus (Ann. Surg. **103:** 310, 1936), and it is suggested that the following stages may be observed:

"Stage 1. No abnormality or slight fraying of the corners of the symphysis.

"Stage 2. Definite decalcification of the bodies of the pubes: this may be uniform or patchy and may involve one or both inferior pubic rami.

"Stage 3. Decalcification may continue until a U-shaped defect is seen at the site of the pubic symphysis.

"Stage 4. Exceptionally the process is associated with sequestrum formation.

"Stage 5. Stage of healing. At first there is recalcification with normal trabecular conformation, and eventually marked narrowing or fusion of the symphysis pubis supervenes. New subperiosteal bone may be laid down in the region of muscle attachments."

Etiology and treatment are discussed.

Sixteen roentgenograms; 1 drawing.

GYNECOLOGY AND OBSTETRICS

"Pelvic Drive" in Obstetrics: An X-Ray Study of 100 Cases. Edwin M. Gold. Am. J. Obst. & Gynec. **59:** 890–896, April 1950.

Caldwell and his associates, while studying the mechanism of labor, pointed out that the soft parts play a role in directing variations in the position of the curved axis of fetal descent within the pelvis. They reasoned that the position of the lower uterine segment and cervix is determined by the fascial supports of the uterus, and that the physical state of these supports and their reaction to the forces of labor may cause alterations in the direction of the fetal presenting part.

Some years ago, Dr. Caldwell suggested to the author that a study of the axis of descent of the fetus within the pelvis might be made by determining by pelvimetric methods the position of the fetal back in relation to the maternal vertebral column during or just before onset of labor.

Three categories of fetopelvic relationships were evident from a study of a large number of lateral roentgenograms: (1) with the fetal back anterior in relation to the maternal spine, the presenting part is directed into the posterior pelvic segment of the inlet; (2) where the fetal spine is directly lateral, the presenting part is directed through the middle of the inlet; (3) when the fetal back is posterior, the presenting part is directed into the forepelvis and against the symphysis. It was also noted that an angle was formed between the fetal and maternal spines, which was designated the "drive angle." When this angle is about 90° the drive is into the posterior pelvis; when it is more acute than 90° the drive is into the middle of the pelvis, and where the "drive angle" tends to parallel the maternal spine, the drive is into the forepelvis. Every case x-rayed by the Caldwell-Moloy technic could be placed in one of these three groups.

One hundred cases studied roentgenologically from 1945 through 1947 at the Jewish Hospital of Brooklyn were used by the author in his study of "pelvic drive" and the "drive angle." No cases of breech presentation were included; in all cases dystocia was suspected. They were grouped as follows:

Group I: Posterior pelvic drive.....48% of cases.
Group II: Midpelvic drive.....34% of cases.
Group III: Forepelvic drive.....18% of cases.

There were 84 per cent primiparas and 16 per cent multiparas in the series; of the multiparas 18.6 per cent were in Group I, 11.7 per cent were in Group II, and 16.6 per cent were in Group III. Most gynecoid pelves were of Group I, most of the android type were of Group III, most of the anthropoid type were of Group II, and most of the platypelloid type were of Group III.

Average duration of labor was longest in Group II and about equal in the others, being of about 50 per cent shorter duration in Groups I and III. The percentage of low forceps and spontaneous delivery was highest in Group I and the percentage of cesarean sections was highest in Group III, closely followed by Group II.

Since it was felt that the anteroposterior diameter of the maternal pelvic inlet might affect the statistical results, measurements were taken in 91 of the cases and found to average practically the same for all groups.

The author belives that an evaluation of "drive" and "drive-angle" should be incorporated in the interpreta-

tion of roentgen pelvimetry, since these two factors as shown by this study are of prognostic import.

Three roentgenograms.

HARVEY J. THOMPSON, JR., M.D.
Jefferson Medical College

A New Simple Method of Fetometry in Breech Presentations. T. E. Rogers and Eugene L. Griffin. Am. J. Obst. & Gynec. **59:** 909–914, April 1950.

The authors have developed a simple method of cephalopelvic measurement in breech deliveries, using the Colcher-Sussman ruler and a modification of the Colcher-Sussman technic.

The patient is placed upon the x-ray table in the recumbent position and the fetal head palpated. The Colcher-Sussman ruler is then placed on the side of the abdomen nearest the fetal head, and, in the average woman, about 6 cm. below the anterior abdominal wall level at the position of the fetal head. The central beam is directed through the fetal skull at 40 inch distance. The patient lies on the table until the first film is developed, and if the wet film reveals a variation in position of the head of over 25° from either the true anteroposterior or true lateral, an abdominal binder is applied directly over the fetal head and drawn as tightly as possible. A second film is then taken, and it is usually found that the binder has converted the fetal head from the oblique to either the anteroposterior or lateral position so that proper measurement can be taken.

The fetal diameters to be measured are the suboccipitobregmatic or the biparietal.

Using this technic, the authors examined 50 patients with breech presentations. The suboccipitobregmatic measurement was made from the film and the results recorded. The same measurement was made on the delivered child and a comparison of the two values made. Results indicate that unless the head is fixed in an oblique position it can be measured to within 0.5 cm. in any patient, and in most instances to within 0.3 cm., which is accurate enough for clinical evaluation of cephalopelvic disproportion.

Four illustrations; 1 table.

HARVEY J. THOMPSON, JR., M.D.
Jefferson Medical College

THE GENITO-URINARY SYSTEM

Tumors and Cysts of the Kidney. Harry C. Rolnick and David Presman. S. Clin. North America **30:** 25–42, February 1950.

Kidney tumors are classified by the authors as follows:

1. Parenchymal tumors
   - A. Cell type
     1. Clear
     2. Granular
     3. Embryonal
   - B. Arrangement of cells
     1. Solid masses or cords
     2. Alveolar
     3. Tubular
   - C. Gross appearance
     1. Solid
     2. Papillary
     3. Cystic
2. Tumors of renal pelvis
   - A. Papillary transitional cell
   - B. Non-papillary squamous cell
   - C. Adenocarcinoma
3. Cysts
   - A. Simple cysts
   - B. Polycystic disease
   - C. Retention, inflammatory, traumatic, peripelvic cysts, and those associated with stones

Classical symptoms of a kidney tumor are hematuria, pain, and a palpable mass in the flank. Simple cysts rarely cause bleeding but polycystic disease frequently does.

Plain films of the abdomen may reveal a mass in the kidney region and occasionally a tumor or cyst may be discovered during roentgen studies of the gastro-intestinal tract. An intravenous urogram may lead to the diagnosis but in most instances retrograde pyelography is preferable.

Parenchymal tumors may cause compression, elongation, or obliteration of the calyces, calyceal distortion, or displacement of the ureter and renal pelvis. The kidney itself may be displaced downward by a tumor arising in the upper pole.

Pelvic tumors usually appear as a filling defect of the pelvis, though the calyces may also be involved.

The radiologic picture of cyst of the kidney depends upon the degree of encroachment upon the pelvis and calyces.

Polycystic disease is always bilateral but may predominate on one side. The appearance is characteristic: the kidneys are enlarged, the infundibula elongated, and the calyces dilated.

Surgery is recommended, followed by roentgen therapy for malignant tumors. Simple cysts do not recur if completely removed. Little can be done for polycystic cases other than rupturing a few of the larger cysts to relieve pressure. The prognosis for malignant kidney tumors is poor, since symptoms are late in appearing and the renal vein is invaded early.

Seventeen figures, including 12 roentgenograms.

ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Six Cases of Wilms' Tumor (Embryonal Carcinosarcoma) One of Which Recovered. Fedor L. Senger, A. L. L. Bell, and James C. Barnett. J. Urol. **63:** 480–486, March 1950.

This paper constitutes a review of all the cases of Wilms' tumor in children seen at Long Island College Hospital in the past twenty-one years. Of the 6 histologically proved cases, 5 proved fatal; one patient has survived. The authors concur in the opinion that if a child lives for two years following operation for Wilms' tumor, his chances of being permanently free of the disease are excellent.

Each of the cases is reported in detail. The patient who recovered received preoperative radiation only. The patient who survived the next longest lived eight and a half months and received no radiation either preoperatively or postoperatively.

At Long Island College Hospital the authors have attempted local deep x-ray therapy preoperatively, hoping that distant metastases had not occurred, and desiring also to shrink the tumor. Postoperative radiation to the scar and tumor bed has also been used. The

reason for the single recovery is unknown, except that apparently no distant spread was present.

ROBERT F. CORKLE, M.D.
University of Pennsylvania

Pheochromocytoma: A Case Report Presenting Unusual Clinical Features, and Successful Surgical Removal. A. W. Middleton. J. Urol. **63:** 446–450, March 1950.

A 47-year-old man complained for one year of attacks which consisted of a sense of pulsation in the epigastrium synchronous with the heart beat. He usually suffered associated intense headache followed by nausea and sometimes vomiting. These episodes lasted about five minutes; they were never induced by physical factors, such as exertion or abdominal palpation.

The physical examination showed nothing abnormal, but the laboratory studies revealed an unusual glucose tolerance curve. Pyelograms, both intravenous and retrograde, offered evidence of a soft-tissue mass above the right kidney, and the ureter showed shortening and pleating, as if forced into a space too small to accommodate it. Later in the course of the disease the blood pressure during an attack reached 200 mm.

At operation, the tumor was successfully removed and proved to be a pheochromocytoma.

One roentgenogram; 1 photomicrograph; 2 graphs.

FRANCISCO CAMPOY, M.D.
University of Pennsylvania

Hydronephrosis Associated with Overhydration. Terrell Covington, Jr., and Wayne Reeser. J. Urol. **63:** 438–440, March 1950.

The authors point out that there are numerous methods of preparing a patient for urography, but state their belief that the type of preparation should be individualized according to the circumstances which reproduce the symptoms.

A 20-year-old white male had intermittent right lower quadrant pain radiating to the back and flank for eight months. The pain was dull in character and lasted for one to two hours. Severe attacks were associated with nausea, vomiting, and a desire to defecate. During one attack the condition was diagnosed as appendicitis, but a normal appendix was removed. The patient was then told that he had a kink in his ureter and a corset was advised, but this did not relieve the symptoms. The only precipitating factor in all instances was an excessive intake of fluid.

The patient was admitted to the hospital in an acute attack of right flank pain, fluids were restricted for fourteen hours, and the subsequent intravenous urogram was normal. A similar attack a few days later was relieved by atropine. It was found that ingestion of 1,500 c.c. of water would reproduce the pain, and an intravenous urogram was obtained during an attack thus induced. This revealed a dilated pelvis on the right and evidence of obstruction at the ureteropelvic junction.

At operation, an aberrant vessel was found and severed, with relief of symptoms.

Two roentgenograms. A. E. O'HARA, M.D.
University of Pennsylvania

Thorotrast Storage after Direct Pyelography. Umberto Cocchi. Radiol. clin. **19:** 118–120, March 1950. (In German)

A case is described showing irregular dense shadows in both kidney regions and in both paravertebral areas. These were of the density of calcium, sharply demarcated and forming a more or less reticular pattern in the kidneys and irregular linear shadows in the paravertebral regions. On plain films the kidneys appeared normal as to size and position. On intravenous pyelograms the calices and pelves were normal as to contour, and no hydronephrosis was present.

The shadows were first believed to represent calcium deposits and the possibility of thyroid or parathyroid metabolic changes, pyelocystitis as a result of *B. coli* infection, heavy metal poisoning, glomerulonephrosis, certain infectious conditions or catarrhal bowel lesions, and osteitis fibrosa were considered. It was discovered, however, that twelve years earlier retrograde pyelography had been done with thorotrast and, through elimination of other factors, it was determined that these abnormal shadows were due to the retention of the thorotrast then used. A similar case from another clinic showed identical findings seven years after a retrograde pyelogram.

Thorotrast is believed to be deposited in the intracellular phagocytes, also in the interstitial tissues, particularly in places where the tubules have been damaged. In several of these areas necrotic changes have been described, with thorotrast deposited in the center of the necrotic masses. The dense shadows are therefore regarded as representing actual storage of the dye over this period of time in the kidney tissues. The paravertebral linear markings indicate dye within the regional nodes and the ureters.

One illustration. E. W. SPACKMAN, M.D.
Fort Worth, Texas

Retrocaval Ureter: Case Report. P. A. Duff. J. Urol. **63:** 496–499, March 1950.

The author points out that retrocaval ureter is being recognized with more frequency in cases in which upper ureteral obstruction is suspected. He reports a case in a 51-year-old white male who was admitted to the hospital on May 28, 1946, with a history of intermittent right flank pain, frequency, nocturia, burning, and passage of mucus and pus in the urine since 1928. An intravenous urogram revealed an irregular outline of the right kidney, with a dilated pelvis and upper ureter. The right ureter was seen to pass medially at the level of the third lumbar vertebrae. The left kidney and pelvis were normal. Cystoscopic examination showed a slightly trabeculated bladder and slight encroachment on the ureter by the prostate. The ureter was shown by a retrograde study to be displaced medially in its middle third and a "vena cavogram," with a catheter in the right ureter, showed the ureter to lie medial to the vena cava.

At operation a retrocaval ureter was found, but because of the damage the kidney had sustained as a result of pyelonephritis, a nephrectomy was performed. The postoperative course was uneventful and the patient was relieved of his symptoms.

Three roentgenograms. A. E. O'HARA, M.D.
University of Pennsylvania

X-Ray Diagnosis of Inflammatory Diseases of the Internal Genital Organs in the Male. Werner Staehler. Fortschr. a. d. Geb. d. Röntgenstrahlen **72:** 202–207, December 1949. (In German)

Special emphasis is laid on genital tuberculosis, for

which the following radiological phenomena are summarized:

I. Changes in the seminal vesicles: (*a*) Characteristic: Lentil-shaped filling defects, moth-eaten contours, tortuosity and indistinct outlines of the radiopaque filling, "flame-like" pattern. (*b*) Not characteristic: Lack of vesicular filling or deficient filling.

II. Changes in the seminal ducts: Cylindrical brush shape, pearl-string shape, cavitation and deficiency of filling due to stenosis.

III. Changes in the prostate: Cavitation and formation of fistulae.

Urethrography is especially valuable in the diagnosis of advanced tuberculosis of the prostate, where it will demonstrate tissue destruction and communication between individual cavities or with the seminal vesicles or the ductus deferens.

Nine roentgenograms. ERNST A. SCHMIDT, M.D.
Denver, Colo.

Perforations in Transurethral Operations. Technic for Immediate Diagnosis and Management of Extravasations. Herbert R. Kenyon. J. A. M. A. **142:** 798–801, March 18, 1950.

Operative injuries are more likely to occur during difficult transurethral resections, but may be associated with almost any type of transurethral procedure. Most lead to extraperitoneal leakage, with fewer intraperitoneal or combined lesions. Interference with free and ample return of irrigating fluid, the development of abdominal pain, nausea, vomiting, muscular rigidity in the lower abdomen, evidence of shock, and fall in blood pressure are common signs of perforation.

The use of cystography or urethrocystography immediately will usually establish the diagnosis, showing the site of perforation and the extent. Any of the media used for intravenous pyelography are ideally suited for this purpose, being sterile and compatible with blood and tissues. Radiographs made after evacuation often show the extravasated medium with greater clarity.

The treatment outlined by the author is primarily treatment of the shock-like state and later operative interference for the perforation if necessary. If necessary, satisfactory cystographic films can be made at the bedside in those cases when the perforation occurs several hours or days after surgery.

Six case reports with details of various types of perforation and excellent illustrations show the value of x-ray diagnostic methods in these injuries.

Eleven roentgenograms.

BERNARD S. KALAYJIAN, M.D.
Detroit, Mich.

THE BLOOD VESSELS

Proximal Femoral Venography. A Preliminary Report. Gene B. Starkloff, Eugene M. Bricker, James J. McDonald, and Louis T. Litzow Ann Surg. **131:** 413–417, March 1950.

For a better evaluation of diseases of the deep and superficial veins of the leg, the authors advocate venography. Their technic is not original but they have had remarkable success with it. The saphenous vein is severed distal to the bulb in the upper thigh. The distal end is ligated, a catheter is inserted into the proximal stump, and 20 c.c. of 35 per cent diodrast are injected in one or two minutes. The patient is in an upright position and no tourniquets are used, so that normal physiological conditions are simulated. Several films are made at the completion of the injection and one, two, and four minutes later.

By means of this procedure the proximal portions of the deep femoral veins are visualized and studied. Delay in emptying and retrograde flow of the contrast medium are significant findings.

Thirteen roentgenograms.

ROBERT A. HAYS, M.D.
Cleveland Clinic Foundation

RADIOTHERAPY

Treatment of Cancer of the Skin by Irradiation. R. C. Burr. J. Canad. Assoc. Radiologists **1:** 2–3, March 1950.

Irradiation is the treatment of choice for cancer of the skin as evidenced by a 99 per cent five-year survival rate in the author's series. The lesion is first biopsied. If it is raised, the protruding portion is removed so that irradiation may be directed into the base. For lesions 1.5 cm. or less in diameter, radium is considered the method of choice. The radium tubes are placed in contact side by side, covering the lesion and a surrounding rim of normal tissue 2 mm. in width. The isodose curves using four, six, and eight 10-mg. tubes thus arranged are shown, the dosages being expressed in r per hour. By this method, treatment time is six hours or less, and a dosage of 2,500 r is delivered to a depth of 5 mm. For lesions greater than 1.5 cm. diameter, deep roentgen therapy (200 kv., 0.5 mm. Cu plus 1.0 mm. Al, 50 cm. distance) is given in three divided doses, on consecutive days, to a total of 2,400 to 3,000 r. With very large lesions, 300 r (skin) daily for fifteen days may be given, to a total of 4,500 r. There is no difference between the reactions produced by radium and x-rays.

Basal-cell and epidermoid carcinoma of the skin show the same incidence, but basal-cell carcinoma has a higher cure rate. Of 473 patients treated with irradiation, only 4 died of their disease; 3 of these had epidermoid carcinoma, and 1 a basal-cell tumor.

Three tables. GABRIEL WHITEMAN, M.D.
Louisville, Ky.

Contact Therapy in Malignant Lesions of the Skin and Mucous Membranes. Origène Dufresne and Germain Pinsonneault. J. Canad. Assoc. Radiologists **1:** 4–7, March 1950. (In French)

Contact roentgen therapy, because of its simplicity, rapidity of action and application, and its efficiency, represents one of the most important improvements in radiation therapy of cancer during the past twenty-five years. Experience obtained while treating 1,854 patients from October 1939 to October 1949 is presented. The lesions treated had a depth of less than 10 mm. and were located in the skin, lip, eyelids, palate, inner surface of the cheek, floor of the mouth, tonsil, gums, breast, penis, and vulva.

A dose of 4,000 to 5,000 r given at 4-cm. distance without filter in 100 to 120 seconds will probably cure completely almost all superficial carcinomas of the mucous membrane and of the skin. An exudative radio-epidermitis appears in three days and heals in six to eight weeks.

The method is suggested as an accessory in a mobile unit used to fight cancer in small centers or rural districts.

CHARLES NICE, M.D.
University of Minnesota

Irradiation as the Preferred Treatment of Cancer of the Lip. George S. Sharp, Herbert F. Williams, and Robert E. Pugh, Jr. J. A. M. A. **142:** 698–707, March 11, 1950.

A series of 206 cases of lower lip cancer treated from 1932 through 1943 is reported. The majority of the lesions were relatively slow growing and superficial. Biopsy was done on all and showed 98 per cent to be of either Grade 1 or Grade 2 histologically. The following clinical classification was used to help determine the scheme of therapy and the prognosis: Stage 1 included all lesions under 2 cm. in diameter; Stage 2 all lesions over 2 cm. in diameter but still confined to the lip; Stage 3 lesions presenting operable unilateral cervical node involvement; Stage 4 cases with invasion of the mandible.

The treatment was by surface radium in 78 per cent of the cases, surface radium combined with interstitial radium in 11.5 per cent, and surgery alone in 9 per cent. Surgery was usually reserved for lesions which because of their size would have required post-radiotherapeutic cheiloplasty.

For lesions of the size usually encountered, a surface plaque was used to deliver in a single treatment the desired dose to the center of the field in accordance with the tables of Quimby. The plaque measured 1 × 1.5 cm. and contained ten 2 mg. radium tubes uniformly arranged. For larger lesions, a larger applicator measuring 2.5 × 1 cm. was used containing 2 sets of ten 2 mg. cells placed in tandem. The equivalent filtration of the plaque and tubes was 0.5 mm. of platinum. A strip of lead 3 mm. thick bent into the shape of an inverted "U" was brought down over the plaque to hold it to the lesion and also to protect the upper lip, and the entire mold was fixed to the face by adhesive tape. Additional protection was obtained by the use of cotton rolls between the upper and lower incisors, and between the lips and the teeth. The time of application averaged 22-1/2 hours or 450 mg. hours (20 mg. × 22-1/2 hours), giving a tissue dose of 6,600 gamma r 3 mm. below the surfaces of the lesion, and 4,160 gamma r at 5 mm. depth.

When the lesion was more than 3 mm. in depth, the treatment distance was increased, necessitating a compensatory increase in treatment time. With a lesion 2 cm. in diameter or less and up to 0.5 cm. in depth, a distance of 0.5 to 1 cm. is satisfactory, but if the lesion exceeds 1 cm. in depth, anterior, posterior, and superior applicators are indicated. In most instances, particularly when dealing with surface lesions over 0.5 cm. deep, where a surface applicator alone was considered inadequate, needles were implanted during the surface treatment or one to two days later to supply additional tumor dose. A mandibular nerve block is effected by 2 per cent procaine and the needles are implanted along the base of the tumor from the lateral aspects so that the ends overlap in the center. The needles used by the authors were of two sizes: 2 mg. of radium with an active length of 11 mm., and 4 mg. of radium with an active length of 23 mm., and each had a filter of 0.5 mm. platinum. The dose delivered by these interstitial sources was computed by using the tables of Quimby or Paterson and Parker.

The five-year absolute cure rate for the series was 84 per cent; the relative cure rate after excluding cases lost to follow-up and deaths from other diseases without evidence of lip cancer was 95 per cent. Of the Stage 1 lesions, which comprised four-fifths of the group, all were cured at the end of five years.

Eighteen cases with metastasis to nodes (9 per cent of the group) showed a 60 per cent five-year cure rate following partial or total neck dissection.

Recurrences after treatment were unusual and were successfully treated by surface application of radium. Secondary breakdown was rare, usually following exposure to sunshine, and responded to conservative care in every instance.

Seventeen illustrations; 2 tables.

CORNELIUS COLANGELO, M.D.
Chicago, Ill.

Malignant Melanoma of the Nose and Sinuses. Joseph G. Schoolman and Harold W. Anderson. Ann. Otol., Rhin. & Laryng. **59:** 124–140, March 1950.

Following a discussion of the histogenesis, histology, and clinical aspects of melanoma, the authors report 6 cases involving the nose and paranasal sinuses. Two of these are believed to be the first on record as arising in the nasal vestibule. Four of the patients were Negroes.

Treatment was as follows:

Case I: Roentgen irradiation, supplemented by interstitial radium.
Case II: Roentgen therapy and nitrogen mustard.
Case III: Roentgen and radium therapy elsewhere; radical resection with postoperative roentgen therapy and nitrogen mustard.
Case IV: Radical resection.
Case V (recurrent): Removal with electric diathermy cutting current; nitrogen mustard; irradiation of lung metastases.
Case VI (recurrent): Surgery followed by further recurrence; electrocautery; minimal irradiation.

Three of the patients died (Cases I, III, and V). Three were alive, but all were known to have residual tumor.

In spite of the poor prognosis, the authors do not consider malignant melanomas necessarily radioresistant. Some are affected by irradiation either primarily or secondarily as a result of interference with their blood supply.

Biopsy, cautery and diathermy seem to stimulate metastasis. Wide excision with the cold knife or irradiation appear to be the therapeutic methods of choice.

Seven illustrations; 3 tables.

STEPHEN N. TAGER, M.D.
Urbana, Ill.

Treatment of Metastases from Cancer of the Breast. Jacob R. Fried and Henry Goldberg, with Section on **Hormonal Therapy of Breast Cancer** by Julian B. Herrmann. Am. J. Roentgenol. **63:** 312–334, March 1950.

Advanced cancer of the breast is best handled by a group of specialists experienced in the treatment of advanced cancer. The most perplexing problems asso-

ciated with this disease are often those concerned with controlling cachexia, vomiting, anemia, and dehydration. After these are solved, attempts to halt further spread of the disease must be made.

The authors report 41.6 per cent local recurrence following surgery in a series of 125 patients undergoing radical mastectomy and followed to their death from metastatic disease. Either surgery or irradiation may be employed in the treatment of these local lesions. If the latter is chosen, the dose is 3,000 to 5,000 r, fractionated. If axillary nodes are involved, irradiation should not be instituted until a positive biopsy is obtained. Edema of the arm does not necessarily mean residual neoplasm since axillary surgery or irradiation may also produce this result.

Supraclavicular metastases are difficult to control. Care must be exercised to distinguish them from cervical ribs, inflammatory swelling, or post-surgical scarring.

Skeletal metastases are found in the following order of frequency: (1) pelvis, (2) spine (especially lumbar), (3) femurs, (4) ribs, (5) skull, (6) shoulder girdle. Routine roentgenograms of the pelvis, chest, and skull should therefore reveal most of them. Pain and local tenderness are the outstanding symptoms and in their presence treatment should be instituted despite absence of x-ray findings. Irradiation may restore the patient to an almost normal existence. Castration of menopausal or pre-menopausal patients produces regression of lesions in 20 to 30 per cent of cases.

Intrathoracic metastases were present in 89 per cent of a group of 75 cases studied postmortem. In most of these the lung, pleura, and mediastinal nodes were involved, with associated involvement of the heart or its coverings in 45 per cent. Rather intense irradiation is required for metastases in the pleura or mediastinum; it frequently brings about striking amelioration of symptoms. Castration sometimes produces marked regression of intrathoracic lesions.

Among 210 cases of advanced breast cancer the abdominal viscera were involved with the following frequency: liver 63 per cent, nodes 54 per cent (based on 75 cases), adrenals 43 per cent, ovaries 23 per cent, spleen 21 per cent, and kidney 17 per cent. Abdominal pain results from metastases to the skeleton, liver or nodes but the symptoms may be manifold and difficult to control. Irradiation is most effective in relieving pain due to enlarged nodes and sometimes in controlling ascites or hydronephrosis due to ureteral obstruction.

The central nervous system shows metastases in 20 to 30 per cent of cases of advanced breast cancer, the meninges, cerebrum, pituitary gland, and cerebellum being involved in that order. Either surgery or irradiation may be effective in relieving intracranial pressure or localized lesions but x-rays must be relied upon in the extensive ones. Tumor doses of at least 3,000 r are usually required.

The authors suggest posterior rhizotomy, anterolateral chordotomy, and prefrontal lobotomy to relieve pain in advanced cases with considerable life expectancy but with no results from irradiation or hormones.

Striking results in some cases have been obtained in treating osseous metastases from breast cancer with testosterone propionate. Pain is relieved in seven to ten days, followed by a feeling of well-being, improvement in general physical state, and x-ray evidence of recalcification of the lesions in two to three months. Duration of this effect varies but may extend for several years. This treatment should not be prophylactic but should be used independently or when irradiation or castration is no longer effective. Undesirable side effects are facial hirsutism, acne, deepening of the voice, dizziness, edema, increase in body weight, and toxic hypercalcemia.

Estrogenic hormone is more effective in the treatment of soft-tissue than of osseous metastases. It has proved especially useful in older women with pulmonary metastases. Uterine bleeding, edema, and hypercalcemia have been observed as side effects.

Twenty roentgenograms; 3 tables.

D. E. VIVIAN, M.D.
Indiana University

Primary Carcinoma of the Lung. A Clinical Study of 1,205 Cases. Irving M. Ariel, Edward E. Avery, Lester Kanter, Jerome R. Head, and Hiram T. Langston. Cancer **3:** 229–239, March 1950.

The absolute increase in the incidence of bronchogenic carcinoma has transferred this malignant neoplasm from its position as a relatively rare entity to one of the most frequent of all human neoplastic processes. Renewed interest in this disease has resulted in more drastic attempts to treat the cancer, and reports indicate that improved survival rates are being achieved. Accordingly, the authors felt that an analysis of 1,205 cases of bronchogenic carcinoma would serve as a base line for comparison of former methods with certain newer technics now being utilized.

In the period from 1931 to 1946 inclusive, 1,205 patients with primary pulmonary cancer were admitted to the Veterans Administration Hospital in Hines, Illinois. Histologic evidence of the nature of the neoplasm was obtainable in 511 instances. In the remainder a compatible clinical picture and roentgenographic evidence, supported by the fact that all of the patients succumbed to the disease, leave little doubt of the diagnosis. Average age in the group of patients studied was 43.2 years. Ninety per cent of the cases occurred in the fourth, fifth, and sixth decades.

No etiological factors that might contribute to the production of bronchogenic carcinoma could be ascertained from this review. The authors list the initial symptoms of pulmonary carcinoma. The leading primary symptom was chest pain, which occurred in 25 per cent of the patients.

Unless treated, bronchogenic carcinoma runs a rapidly lethal course. In 340 untreated patients, the duration of life from onset of the symptoms to death was nine and four-tenths months.

Surgical extirpation of the involved lobe (or preferably the entire lung) is the only satisfactory method of treating lung cancer to date. At Hines Hospital the first surgical procedure for lung cancer was performed in 1937. In the ten-year span from 1937 to 1947, 1,057 patients with bronchogenic carcinoma were admitted, and 141, or 13.4 per cent, of this group were subjected to operative intervention. In 65 per cent of these cases the thorax was merely explored and the lesion deemed inoperable. Surgical extirpation of the involved lung or lobe could be accomplished in 49 instances, or in 34 per cent of the cases subjected to surgery. The five-year survival rate of the 49 patients on whom resection was done was 7.1 per cent, and the average duration of life of all patients subjected to resection was fourteen months.

Among 723 patients receiving roentgen therapy, for whom the history is available, the average duration of life was 12.8 months. The authors attempt to evaluate the effects of various dosages upon survival. Patients are divided into groups who received a total dose, as measured in air, of (1) less than 5,000 r, (2) 5,000 to 6,500 r, (3) more than 6,500 r. The best survival rates were obtained in a group of 80 patients who received a total dose of from 5,000 to 6,000 r. Administering doses in excess of 6,500 r did not produce better results. Two hundred patients who received less than 5,000 r lived for an average of 1.1 months. These patients represent the group that arrived in the most critical condition and were not candidates for the larger doses.

The authors discuss other methods for palliative treatment of pulmonary cancer, including external irradiation by teleoradium, interstitial irradiation, and nitrogen-mustard therapy.

Seven illustrations; 3 tables.

DONALD S. CHILDS, JR., M.D.
The Mayo Clinic

Management of Carcinoma of the Cervix, with Emphasis on the Controversial Factors in the Treatment. Herbert E. Schmitz. S. Clin. North America **30:** 249–257, February 1950.

Pre-invasive carcinoma of the cervix (carcinoma *in situ*) is best treated, in the opinion of the author, by total hysterectomy. More conservative measures, such as amputation, conization, or cauterization, though they have been successful in some cases, entail the risk of failure because of unrecognized invasion. Radical surgery and irradiation, on the other hand, are not considered necessary and are undesirable because these cases are usually in a relatively early age group (average 38 years).

In invasive cancer, irradiation is considered the treatment of choice in all but a few patients with far advanced disease in good enough condition to stand pelvic evisceration. By serial biopsy and inspection some cases can be detected which do not respond to irradiation. For these also, surgery is recommended. Recurrent disease in patients who have already received extensive irradiation is another indication for surgery.

Four diagrams; 1 table.

ZAC F. ENDRESS, M.D.
Pontiac, Mich.

A Study of Survivals in Hodgkin's Disease Treated Radiologically. M. Vera Peters. Am. J. Roentgenol. **63:** 299–311, March 1950.

Of 257 cases of Hodgkin's disease treated by irradiation at Toronto General Hospital between 1924 and 1942, 113 histologically verified cases were subjected to statistical evaluation. The sex incidence, 2 males to 1 female, is as reported by others; the highest incidence was in the age group twenty to thirty years. About 50 per cent of the entire series showed the initial site of involvement in the cervical lymph nodes.

The gross over-all five-year survival was 51 per cent. Twenty-two per cent failed to survive one year, another 16 per cent failed to live two years. Survival was directly correlated with the extent of involvement on admission, the presence of constitutional symptoms on admission, and to a lesser degree with the severity of the pathologic picture of the lesion. Females seemed to survive longer than males, and of 9 patients living more than fifteen years, 7 were women. Up to age fifty, the five-year survival is better than average; beyond fifty it is far below average.

The presence or absence of constitutional symptoms on admission exerts a sufficiently important influence on prognosis to warrant consideration in the clinical classification of this disease. Stage I represents involvement of only one lymph node region or a single lesion elsewhere, with no constitutional symptoms; Stage II, involvement of two or more proximal lymph node regions confined to either the upper or lower trunk, with or without constitutional symptoms; Stage III, involvement of multiple lymph node regions with or without constitutional symptoms or acute Hodgkin's disease with no obvious lymphatic involvement.

Two methods of irradiation are analyzed. Intensive irradiation of involved lymph nodes (1,800 to 5,000 r at 400 kv.) and intensive treatment of involved nodes plus several prophylactic series (400 to 800 r) to the uninvolved peripheral lymphatic regions gave similar results in Stage I. In Stages II and III, the ultimate results showed 17 per cent improvement in five-year survivals of cases receiving prophylactic irradiation. Though this figure is not statistically significant, the author advocates prophylactic treatment at least of the neighboring uninvolved lymph node areas.

One graph; 15 tables.

J. A. CAMPBELL, M.D.
Indiana University

Treatment of the Lymphomas and Other Neoplastic Diseases with Nitrogen Mustard. Louis K. ...pert, Ezra M. Greenspan, and Stanley S. Peterson. Ann. Int. Med. **32:** 393–432, March 1950.

The beta-chloroethyl amines, or nitrogen mustards, have been used since 1942 in the treatment of lymphomas and in a variety of miscellaneous malignant conditions. The relative effectiveness of the mustard compounds and roentgen therapy is still being evaluated. The authors treated a series of patients at the Walter Reed Hospital with various types of lymphoma and other neoplastic disease by methyl bis beta chloroethylamine hydrochloride (HN_2) and attempted to compare the effects with those of roentgen therapy, though this could not always be done with accuracy. Certain patients with multiple lesions were given x-ray irradiation over local areas, and HN_2 therapy at the same time. The rate of recurrence in the areas not treated with x-ray was compared with those which had been irradiated. Other patients were given HN_2, and after the length of time for recurrence of enlarged lymph nodes was ascertained, they were treated with roentgen radiation and the period of remission again observed. Finally, patients who had been treated with x-ray were subsequently given HN_2 and the results compared.

Favorable, though temporary, effects following nitrogen mustard were observed in a majority of 27 individuals with Hodgkin's disease, in 3 with giant follicular lymphoblastoma and in 2 with lympholeukosarcoma (Sternberg). In patients with lymphosarcoma, reticulum-cell sarcoma, chronic lymphatic leukemia, subacute myeloid leukemia, sarcoidosis and various carcinomas, little or no significant beneficial effect was seen, even though varying degrees of tumor shrinkage were produced.

In the group of patients with Hodgkin's disease, only 2 were adequately controlled with repeated courses of HN_2 alone, for periods of more than a year. In 17 individuals x-ray therapy was considered necessary to produce more prolonged remissions than were obtained with HN_2. Panhematopenia was only occasionally a limiting factor in the continuation of treatment. The occurrence of thrombopenia and purpura was the most serious complication which was encountered.

Nitrogen mustard therapy appeared to be most suitably indicated in the following clinical types of Hodgkin's disease: (1) widespread involvement which could not be treated adequately with x-ray; (2) cases with lymphadenopathy and marked constitutional symptoms (fever, weight loss, etc.); (3) those with fever but without demonstrable enlarged nodes ("occult" febrile type); (4) cases with visceral involvement; and (5) terminal cases which had become "resistant" to roentgen therapy. Radiation was the therapy of choice in patients with relatively localized disease in the peripheral, mediastinal, or retroperitoneal regions, with obstructive lesions about the spinal cord, biliary tract, ureters, or great vessels, with bone involvement, and with fibrosing types of Hodgkin's disease.

No instance was observed of a favorable response to HN_2 therapy, either symptomatically or in shrinkage of observable neoplastic tissue, in a lesion which was known to be resistant to intensive x-ray treatment; nor was the contrary observed, namely, a lack of some degree of response to HN_2 in lesions known to be radiation-sensitive.

Twelve roentgenograms; 1 chart; 1 table.

STEPHEN N. TAGER, M.D.
Urbana, Ill.

Observations on a Combined Colchicine and Roentgen Therapy in Leukemia. Edwin Keibl and Anny Lötsch. Schweiz. med. Wchnschr. **80:** 228–231, March 4, 1950. (In German)

Although colchicine alone has no therapeutic effect on the white blood cells, the addition of this drug to irradiation produced a potentiation of the irradiation effects, causing a greater shift toward normal of both the total white cell count and the differential distribution, in 3 cases of myelogenous leukemia which had showed resistance to irradiation alone. The authors advocate this form of therapy, with injection of 2 mg. colchicine subcutaneously before each x-ray treatment, especially in patients showing radioresistance. The oral administration of colchicine was less effective. [The observations recorded do not adequately confirm the conclusions drawn, as there was an insufficient control with x-ray alone to distinguish clearly a difference when colchicine was used. The idea is nevertheless an interesting one, which deserves fuller study.—L. G. J.]

Five graphs.

LEWIS G. JACOBS, M.D.
Oakland, Calif.

Roentgen Therapy of Cushing's Syndrome (Pituitary Basophilism); Report of a Case Observed for Eleven Years. Ernst A. Pohle and Irving Weissman. Ann. Int. Medicine **32:** 542–548, March 1950.

A 23-year old white male was first seen at the State of Wisconsin General Hospital on March 23, 1937. Roentgenograms of the skull, spine, and long bones revealed generalized osteoporosis of all the bones, with compression fractures of the fifth and tenth thoracic and lower four lumbar vertebrae due to the marked demineralization. The sella at first appeared normal but later examinations (1938) revealed definite enlargement of the left side, giving a double contour to the floor and dorsum.

At first admission, the patient received a series of x-ray treatments to the pituitary region, 4 × 100 r to the right and left temporal and glabellar regions through a 4 × 4 cm. portal (50 cm. distance, h.v.l. 1.05 mm. Cu). This series was repeated in May, and in June 1937 a third series was given, with 150 r to the same three portals. No change was noted in the signs or symptoms.

In August 1937, a laparotomy was done to rule out abnormality of the adrenal glands. Both adrenals were found to be normal in size and shape, without evidence of hyperplasia. A fourth series of x-ray therapy was administered to the pituitary area at this time, through right and left temporal portals, 6 × 100 r (h.v.l. 1.05 mm. Cu). The patient left the hospital slightly improved.

Between October 1937 and August 1941, there were nine periods of hospitalization. In January 1938, the patient received a fifth series of x-ray treatments to the pituitary gland, consisting of 6 × 300 r, through right and left temporal and bregmatic areas (50 cm. distance, 7.5 × 7.5 cm. portals). In December 1947 a sixth series was given, 8 × 150 r, through three 4 × 4 cm. portals (h.v.l. 1.05 mm. Cu).

On Feb. 24, 1948, a right frontal craniotomy was performed and hypophysectomy was attempted. No adenoma was found. The microscopic examination revealed only fibrosis and atrophy of the anterior lobe of the pituitary.

On April 1, 1948, a repair of an abdominal incisional hernia was attempted. The wound failed to heal and the patient declined rapidly. Secondary infection of the operative wound occurred, there was rapid elevation of non-protein nitrogen and creatinine, and death ensued on April 15.

Postmortem examination showed diffuse enlargement of both adrenal glands, their weight being more than twice the normal. No adenomas were present. The tissue remaining in the sella turcica again showed atrophy and fibrosis with little recognizable normal gland. This was considered evidence of the ability of roentgen irradiation to eliminate hyperfunction of the gland.

The authors believe that in this case irradiation of the pituitary was the only effective agent in causing remission of symptoms for a period of eight years. It is concluded, therefore, that radiation therapy can produce beneficial effects in Cushing's syndrome.

Two roentgenograms; 5 photographs.

STEPHEN N. TAGER, M.D.
Urbana, Ill.

Multiple Idiopathic Hemorrhagic Sarcoma: Case Report (Idiopathic Multiple Pigmented Sarcoma). Carl M. Akwa, Joseph Kanter, and Leonard S. Markson. Urol. & Cutan. Rev. **54:** 157–160, March 1950.

Idiopathic multiple hemorrhagic sarcoma was first described by Kaposi in 1872. Since that time the number of reported cases has risen to over 600. The disease usually occurs in the latter decades of life, but cases have been described in children. It is usually found in males who live or have lived in Mediterranean

countries. The classical lesions are bluish-red to reddish-brown nodules, varying from the size of a millet seed to that of a pea. They usually occur spontaneously on the extremities though involvement of the gums, glans penis, inguinal nodes, pharynx and larynx, heart, bowel, and mediastinum has been reported.

The authors' patient was a 58-year-old male, a native of Greece, who complained of pain and swelling of the left leg and foot of thirty-one years' duration. He had been treated symptomatically until 1929, when a diagnosis of Kaposi sarcoma was made. Roentgen therapy at that time afforded immediate relief. Additional roentgen therapy was given in 1935. At the present admission, in 1949, lesions involved the entire left leg and both hands. Treatment was administered to involved areas with the following factors: 140 kv., 15 ma., 50 cm. distance, inherent filtration of 2 mm. Al plus 0.25 mm Cu and 1.0 mm. Al, 16 r per min. The total skin doses ranged, according to depth and size of lesion, from 400 to 1,800 r. Irradiation was followed by marked relief from pain and flattening of most of the papules. During treatment at the hospital, new lesions developed on the right foot and right hand.

Six illustrations. RODERICK L. TONDREAU, M.D.
Lincoln, Nebr.

The Nasopharyngeal Radium Applicator in the Treatment and Prevention of Deafness. E. J. Smith and E. E. Scharfe. Canad. M. A. J. **62:** 150–156, February 1950.

Irradiation of nasopharyngeal lymphoid tissue has a definite place in the restoration of the patency of the eustachian tube. According to Crowe, normally occurring or recurring nasopharyngeal lymphoid tissue under the stimulation of repeated infections or allergy enlarges in size and, if it is located in or near the nasopharyngeal orifice of the eustachian tube, produces some degree of obstruction. The effect of irradiation is to prevent mitosis in the germinal centers of this lymphoid tissue.

The applicator in most popular use at present contains 50 mg. of radium sulfate enclosed in a Monel metal tubular chamber. Monel filters allow both beta and gamma radiation to pass through in the proportion of approximately 80 per cent beta and 20 per cent gamma.

The authors use this type applicator 8½ minutes on each side. Three treatments are given at intervals of two or three weeks. The middle of the radium containing chamber should be in direct contact with the tissue in the fossa of Rosenmüller or the orifice of the eustachian tube.

Irradiation of the nasopharyngeal lymphoid tissue does not replace a properly performed adenoidectomy. It is applicable when there is definite evidence of eustachian tube obstruction such as: (*a*) deafness as shown by audiometry, (*b*) tympanic membrane changes, (*c*) abnormal eustachian orifices. Improvement in hearing frequently follows irradiation. This form of treatment is not without potential danger and should not be used indiscriminately. The degree of success is at least partly dependent on the age of the patient and the duration of symptoms.

Three tables are included showing the authors' results in 42 cases which were adequately followed.

ROBERT H. LEAMING, M.D.
Jefferson Medical College

Radium Therapy for Lymphoid Tissue in the Nasopharynx. Edwin B. Bilchick and Albert R. Kolar. Ann. Otol., Rhin. & Laryng. **59:** 78–89, March 1950.

This report is based on a total of 468 cases from the Otolaryngological Department of the Columbia-Presbyterian Medical Center, New York. Records of 253 of these were available, though not all were complete in every respect. The comments involve mainly the use of the Monel metal applicator standardized by Crowe for the Army Air Force, which has been repeatedly described.

For delivery of the calculated dosage, the side of the applicator should be exactly on the edge of the eustachian tube. Exact placement is made impossible, however, by variations in the depth and width of the nasopharynx, in the size and degree of shrinkage of the inferior turbinates, the presence of narrow nares and septal deviations, especially in small children. The radiation dose is roughly calculated by Dr. Edith Quimby as follows: for radium filtered by 0.3 mm. Monel metal, 75 per cent beta and 25 per cent gamma radiation. The 50-mg. applicator used for 6 2/3 minutes should deliver 1,500 r at a depth of 1 mm. in tissue; in 12 1/2 minutes 2,860 r. At a depth of 1 cm. the dose is approximately 50 r.

The patients in the present series complained of otic, nasopharyngeal, or posterior nasal symptoms. Treatments were not limited to patients with deafness. Commonest symptoms recorded, in order of frequency, were: loss of hearing, tinnitus and vertigo, recurrent ear and throat infections, stuffy nose, postnasal discharge, and asthma. Objective findings, aside from the presence of lymphoid tissue in the nasopharynx, were principally recurrent conductive deafness, high tone deafness, and chronic suppurative otitis media.

It was found convenient to separate the cases into two age groups, children up to fifteen and those over fifteen. Of 104 children who comprised the first group, 68 complained of deafness, shown in the initial audiogram in 57 cases. Among this group were 22 cases of nerve deafness and 35 cases of conductive deafness. In another group of 30 children complaining of colds, coughs, or discharging ears, there were 13 cases of conductive deafness. In patients with nerve deafness, only one was found to be improved. Treatment of cases of conductive deafness, however, resulted in substantial improvement in 37 of the 48 cases.

Of 148 patients over fifteen years of age, 102 had initial objective deafness (72 conductive deafness, 30 nerve deafness). Only 2 of the cases of nerve deafness were improved by treatment, whereas 36 cases of conductive deafness were improved. In the group with discharging ears, tinnitus, vertigo, or postnasal discharge, only occasional improvement was observed.

The authors prefer x-ray therapy to radium when the lymphoid tissue extends beyond the eustachian tube orifice, or when the pathologic process involves the middle ear or extends below the nasopharynx into the pharynx and causes symptoms. The x-ray dosage was 75 to 100 r per sitting, twice a week, until 1,000 r was given to each side.

A review of those patients who received roentgen therapy indicates some improvement, but not such a high percentage as in the radium group. Radium is easier to use, and does not tend toward parotid irritation and dryness of the pharynx. Both methods have their place, and continued comparisons will eventually determine their relative efficacy and safety.

Radium therapy of the nasopharynx to reduce lymphoid hyperplasia is an excellent effective method of prevention and therapy for conductive deafness in children. A large proportion of adults with conductive deafness were also greatly benefited by this treatment, but the percentage of improvement is less than in children.

Four illustrations.

STEPHEN N. TAGER, M.D.
Urbana, Ill.

Evaluation of Irradiation of Pharyngeal and Nasopharyngeal Lymphoid Tissue. Francis L. Lederer. Ann. Otol., Rhin. & Laryng. **59:** 102–111, March 1950.

The author, who is an otolaryngologist, discusses the use of irradiation of lymphoid tissue in the treatment of deafness and quotes varying opinions as to its dangers. He has derived much of his information from Wachowski (presumably by personal communication) and quotes that radiologist at length.

With reference to use of the Crowe Monel applicator, using 50 mg. of radium salt or 50 mc. of radon either as an immediate postadenoidectomy procedure or in cases of so-called granular lymphoid hyperplasia following adenoidectomy, radiologists are not agreed that Crowe is correct in assuming a harmlessness of application. Even when three 8 1/2-minute applications are made at two-week intervals, each application delivers over one minimal skin erythema dose to the mucosa of the lateral wall of the pharynx.

A history of previous irradiation is of extreme importance. Though no malignant transformation resulting from this type of therapy has been reported, the possibility of its occurrence from repeated courses of therapy by succeeding therapists must be considered.

Wachowski believes that the lymphoid tissue can extend into the eustachian tube and points out that, since the zone of influence of the Crowe applicator is limited (practically all of the beta rays are absorbed in the first 5 to 7 mm. of tissue), such cases are not benefited by beta therapy. He has used high-voltage roentgen therapy, with filtration sufficient to give a half-value layer of 1 mm. of copper. Where the infectious manifestations were most prominent, he employed what he designates as *Technic 1*, delivering 100 r (in air) to portals covering the entire sinus and pharyngeal areas, one side being treated at a time. Sides were alternated and treatments given every three or four days until each side received 100 r × 2. Where hyperplastic lymphoid manifestations were most prominent, *Technic 2*, delivering 100 r (in air) to both sides of the face and pharynx at one sitting, was used. This dose was repeated four times at weekly intervals (400 r × 4 to each side.) Occasionally, if the films of the paranasal sinuses showed no involvement and symptoms and findings of sinus disease were absent, only the pharynx was treated (100 r × 4 to each side). In young infants, the dose was reduced to 50 r × 4 and in children of three to four years of age, the average dose was 75 r × 4. *Technic 2* usually delivered 100 to 125 r per sitting to the midline of the pharynx in the average child (facial diameter 12–14 cm. at the zygoma), and *Technic 1* gave one-half of that dose per sitting.

While Wachowski has no objection to the employment of the Crowe beta-ray pharyngeal applicator when used after adenoidectomy or for small recurrent lymphoid masses, and in reasonable doses, he believes that for most pharyngeal conditions as seen by him roentgen therapy is preferable.

The final conclusion reached by the author is that irradiation of the nasopharynx by standardized technics is without danger. It is not a substitute for surgery, however, and should be confined to those cases of conduction deafness associated with the proved presence of lymphoid hyperplasia in and about the eustachian tube orifices. In competent hands, no great advantage is to be had from radium over x-ray irradiation.

STEPHEN N. TAGER, M.D.
Urbana, Ill.

Radiation Exposure of Personnel Handling the Monel Metal Nasopharyngeal Radium Applicator. Henry J. Rubin, Barney M. Kully, and Raymond D. Finkle. Ann. Otol., Rhin., & Laryng. **59:** 90–101, March 1950.

An investigation was undertaken to determine the amount of radiation to which the otologist and his assistants are exposed in using the 50-mg. Monel nasopharyngeal radium applicator. Radiation measuring devices employed in these studies were of two types, the ionization chamber and photographic film. To estimate the amount of radiation received by the hands and fingers a special form of film meter is available. It consists of a plastic ring with a large signet, within which is a small circle of photographic film and several metallic filters.

It was found that little gamma radiation is absorbed by the patient when the applicator is in position in the nasopharynx.

A series of 60 treatments were carried out with a signet-ring film badge mounted on the end of the right middle finger and 60 treatments with a ring on the tip of the left index finger. The right-hand finger showed about 50 milliroentgens (mr.) per treatment, the left 60 mr. The average value for the left index finger tip was higher, since it was carried forward on the speculum.

To determine the amount of radiation reaching an entire finger, pen-shaped self-reading dosimeters were taped to the index finger of each hand and individual readings were made during the introductory stages of a series of treatments. Dosage averaged approximately 25 mr. for the right index finger and 27 mr. for the left. These figures emphasize the protective merit of distance.

From film badge records and from repeated dosimeter readings, it was shown that the physician receives an average total body dose of 3 to 6 mr. and the nurse 4 to 6 mr. per treatment, assuming that they remain a distance of 10 ft. from the patient during a 12-minute treatment period. Other personnel showed exposure figures far below these. If the physician exercises reasonable caution and holds the applicator away from his body, the fingers are the limiting factor in the number of treatments which he may administer with safety. A physician who follows the described technic should limit himself to 12 treatments a week. This is many less than heretofore considered safe.

The tolerance dose for the whole body is 300 mr. per week, and 600 mr. per week has been regarded by the authors as permissible exposure to the hands and fingers, pending official recommendations.

If the technic of any physician differs appreciably from the one herein described, it should be monitored

to ascertain the number of treatments that may be administered without exceeding tolerance.

Two photographs; 4 tables.

STEPHEN N. TAGER, M.D.
Urbana, Ill.

Treatment of Uterine Fibromyomas. Edward Allen. S. Clin. North America **30:** 219–230, February 1950.

Uncomplicated fibroids or those causing no symptoms do not require treatment. Pain, pressure, metrorrhagia, temperature elevation, leukorrhea, or rapid growth indicate complications and should lead to prompt surgical measures. Myomectomy should be considered in younger women desirous of having children. If hysterectomy is necessary, the vaginal operation is preferable, and total removal should be done because of the high incidence of cervical stump carcinoma. Irradiation, in the author's opinion, has in general no place in the treatment of complicated fibromyomas. The patient's difficulties are increased by the abrupt induction of the menopause while the tumorous useless uterus is retained, possibly to be the site at a later date of some serious condition such as cancer or stricture of the cervix.

ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Irradiation of the Pituitary Gland in Hypertensive Vascular Disease. Maurice M. Best, Walter S. Coe, John Walker Moore, Edsel S. Reed, and Herbert L. Clay. Am. J. M. Sc. **219:** 276–280, March 1950.

Of 43 patients with hypertension, 25 were given roentgen therapy for an estimated 1,100 r to the pituitary area in ten days; the other 18 had no x-ray therapy, but their management was otherwise identical.

No significant objective improvement was noted in either group, while subjective improvement was slightly higher in the control group (77 per cent) than in the group treated with x-ray therapy (68 per cent).

The technical factors used were: 200 kv., 15 ma., added filter 2 mm. Cu, target-skin distance 50 cm., 48 sq. cm. right and left lateral temporal ports. Two hundred roentgens (in air) were delivered daily to a single field until each port had received 1,000 air r. The calculated dose to the pituitary was 1,100 r in ten days.

CORNELIUS COLANGELO, M.D.
Chicago, Ill.

Two tables.

Presentation of the Results of Cancer Treatment. Ralston Paterson and Margaret Tod. Brit. J. Radiol. **23:** 146–150, March 1950.

This paper is concerned with encouraging a uniform method of presenting the results of cancer treatment. Four basic essentials are suggested: simplicity, showing of all relevant figures, one agreed method of presenting percentage results, and fixed reporting periods.

Three methods of reporting percentage survivals are suggested: the net survival, the actuarial, and the crude survival. The net survival method starts with total cases treated, from which is deducted the number dead of intercurrent disease and of those untraced. The actuarial method follows the methods of life-table construction. This is superior to the net survival but still makes deductions and assumptions in untraced cases and for those who have died of other causes. The crude survival rate is the total number alive divided by the total number of cases. This latter method is recommended, as it is simple and exact and can be applied to any sample.

Three tables.

SYDNEY J. HAWLEY, M.D.
Seattle, Wash.

Protective Materials for Field Definition in Radiation Therapy. E. Dale Trout and R. M. Gager. Am. J. Roentgenol. **63:** 396–408, March 1950.

The use of various protective materials as beam limiters is described by the authors. Transmission curves and tables are presented for lead, brass, steel, lead rubber, lead glass, and plate glass over a range of 60 to 2,000 kv. The "readable" graphs provide the roentgenologist and/or physicist with an excellent reference for determining, under any particular set of conditions, the amount of radiation reaching the patient on areas proximal to that under treatment. Depending upon the protective requirements, the necessary thickness of any protective material can be ascertained. These graphs should find wide use in the field of radiation therapy.

JAMES DURLACHER, M.D.
Indiana University

RADIOISOTOPES

Concentration of Iodine in the Human Stomach and Other Tissues as Determined with Radioactive Iodine. Richard E. Goldsmith, Charles D. Stevens, and Leon Schiff, with the technical assistance of Patricia Quinlin, Mary Ann Meinken, and Paul H. Stewart. J. Lab. & Clin. Med. **35:** 497–503, April 1950.

The distribution of I^{131} in the tissues of 14 persons injected intravenously with varying quantities of radioactively labeled sodium iodide was measured. All of these individuals came to autopsy within three to one hundred and fifty-nine hours after the administration of the iodine.

The findings are presented in tabular form. The thyroid gland contained much higher concentrations of I^{131} than did the blood serum. Stomach tissue from 10 of the 13 subjects sampled contained two or more times the concentration of I^{131} found in the blood serum, this high concentration being in contrast to the behavior of chloride. None of the other nine tissues examined showed similar ability to concentrate the I^{131}.

In tissues other than the stomach and thyroid, I^{131} was distributed like chloride only in those individuals who received large quantities of sodium iodide and who died shortly thereafter.

Influence of Self-Absorption, Volatilization, and Deliquescence in Counting of Radioelements. Frank J. Kelly, C. Thorpe Ray, S. A. Threefoot, and G. E. Burch. J. Lab. & Clin. Med. **35:** 606–621, April 1950.

A study of the behavior of $Hg^{203,205}$, Cl^{36}, Na^{22}, Na^{24}, K^{42}, P^{32}, and I^{131} in water, human urine, and human plasma, *in vitro* and *in vivo*, indicates that self-absorption, volatilization, and deliquescence offer special problems in radiobiology. Although these factors behave exactly as would be expected, they may be overlooked because of some of the peculiar experimental

conditions encountered in biologic investigations. A correlation of gravimetric and radiometric determinations of preparations of the above-mentioned isotopes in water, urine, and plasma on filter paper disks after drying them at various temperatures revealed that to control these factors careful attention should be paid to the chemical environment and, more important, the method and temperature of drying the biologic materials for counting.

Ten figures.

A Method of Preparing Biologic Fluids for Counting of Radioelements. George Burch, Paul Reaser, Thorpe Ray, and Sam Threefoot. J. Lab. & Clin. Med. **35:** 626–630, April 1950.

A Micropipette for Preparation of Samples for Counting in Radiobiology. George Burch, Paul Reaser, Sam Threefoot, and Thorpe Ray. J. Lab. & Clin. Med. **35:** 631–633, April 1950.

The authors describe their method of preparing samples of biologic fluids containing radioelements employed in tracer studies, which they have found to be simple, accurate, inexpensive, and dependable.

A single filter paper disk is placed in the center of a metal disk and the material for counting is dropped from a micropipette (described in the second article) onto the filter paper at different points to insure uniform spreading. For disks of the size used, 0.25 to 0.30 c.c. of any biologic fluid will uniformly saturate the filter paper without a tendency to spread beyond, onto the edges of the metal disk. After the sample has been dropped upon the filter paper disk, the preparation is set aside to dry. After drying, the surface of the metal disk and the back of the filter paper disk are covered with a thin film of rubber cement. The surfaces of the metal and filter paper disks covered by the cement are brought together, and the paper disk is pressed smoothly into place. No significant error is produced by coating the tin disks with the rubber cement, since there is no demonstrable adhesion of radioelements to the disks after drying is completed. Once the sample has dried, touching the disks of filter paper will not produce any demonstrable errors or remove any measurable amounts of the radioelements.

Each preparation may be easily and permanently labeled by writing a code number or label upon the white filter paper before the biologic fluid is placed upon it. Because the disks are so inexpensive, the necessity of cleaning them for re-use is eliminated and they may be discarded or filed for future reference.

This method of preparing samples has been studied sufficiently only for use with glass and mica window counters. Observers who undertake this procedure should standardize it for their own experiments.

The Quantitative Determination of Gamma Radiation in Biological Research. R. F. Hill, G. J. Hine, and L. D. Marinelli. Am. J. Roentgenol. **63:** 160–169, February 1950.

One who attempts to detect gamma radiation emitted from radioactive isotopes as a means of determining the presence and concentration of a given isotope in different media is confronted with a multitude of difficult problems. The Geiger-Müller counter is the instrument in common usage, but is limited in its sensitivity to gamma radiation. The scintillation counter offers certain advantages in this respect.

I^{131} was used quite extensively for measurement of the gamma rays from thyroid tumors. The difficulties encountered were (1) poor uptake of I^{131}, (2) tumor size, (3) anatomical location, and (4) the presence of other tumors near the thyroid.

The angle subtended by the counter is the means of determining activity of different sources. This angle can be limited by a lead diaphragm or a fixed lead cylinder, depending upon the material or problem confronting the worker.

Three tables for comparison and seven illustrations of the Geiger-Müller counter, scintillation chamber, lead shields to define apertures of the counter, and movable lead diaphragms for varying aperture size are shown.

CHALMERS S. POOL, M.D.
University of Arkansas

Distribution of Radioactivity in Rats and Man After Intravenous Administration of Diethyl β-Radioiodoethyl Amine Hydrochloride and of Radioactive Sodium Iodide. Alexander M. Rutenburg, Orrie M. Friedman, and Arnold M. Seligman. Cancer **3:** 336–341, March 1950.

The authors report the distribution of radioactivity in the tissues of rats bearing Bagg lymphosarcoma, and in one patient with reticulum-cell sarcoma following the intravenous injection of radioactive diethyl beta-iodoethyl amine hydrochloride, of sodium iodide labeled with radioiodine, and of carrier-free radioactive sodium iodide. A comparison of the rate of disappearance of radioactivity from the blood and tissues of the rats indicated that most of the mustard rapidly cyclized to the immonium ion with loss of iodide ion, but that a small fraction persisted in the blood, reached tissues intact, and penetrated the cells.

In the patient with reticulum-cell sarcoma of the tonsil there was higher concentration of radioactivity in tumor, blood, and muscle following the injection of mustard than following the injection of sodium iodide.

Three illustrations. DONALD S. CHILDS, JR., M.D.
The Mayo Clinic

Distribution Studies in Mice Following Intravenous Injection of Methyl-bis(β-Iodoethyl) Amine Hydrochloride Prepared with Radioactive Iodine. Arnold M. Seligman, Orrie M. Friedman, and Alexander M. Rutenburg. Cancer **3:** 342–347, March 1950.

Because of the pronounced chemical reactivity of the nitrogen mustards, it was considered of interest to determine whether these amines reach the cells of normal and neoplastic tissue unaltered in any appreciable quantity. The authors report distribution studies in mice of a nitrogen mustard in which radioiodine (I^{131}) was substituted for the chlorine. The content of radioactivity in the tissues of normal and tumor-bearing mice at various intervals following the intravenous administration of this substance was determined. A comparison of the rate of disappearance from blood and tissues and the appearance in the urine of radioactivity following intravenous injection of both nitrogen mustard with radioiodine and radioactive sodium iodide indicated that the mustard reacted very rapidly with the formation of radioactive iodide or ion, so that the rate of disappearance of radioactivity was similar to that of sodium iodide. Within the limits of this technic, evidence that uncyclized mustard reaches the tissues intact and penetrates cells was provided only in the lung.

Four tables. DONALD S. CHILDS, JR., M.D.
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EFFECTS OF RADIATION

A Histopathologic Study of Radiation Injuries of the Skin. H. A. Teloh, M. L. Mason, and M. C. Wheelock. Surg., Gynec. & Obst. **90:** 335–348, March 1950.

Despite rigid criteria and standards for x-ray equipment and wide dissemination of knowledge on methods of prevention of adventitial body irradiation, the serious end-results of cutaneous radiation are seen in greater numbers.

The authors studied 121 cases of post-irradiation dermatitis, of which 34 or 28.1 per cent showed definite evidence of carcinoma. The greatest incidence of malignant change in the skin occurred in individuals receiving repeated small doses of radiation for long periods, *i.e.*, physicians, roentgenologists, dentists, and technicians. Intensive irradiation for deep-seated lesions is not often the cause of malignant change. Radiation therapy for benign conditions, with production of radiation dermatitis was much more frequently encountered, and a significant number of such cases showed neoplastic change. In the latter group it was noted that the radiation dermatitis was much more extensive and disabling than the original benign lesion for which treatment was given.

The results of a histologic study of 121 cases of radiation dermatitis are given and the authors suggest a histologic classification of radiation dermatitis based upon epidermal changes. Five categories were established with criteria for each class:

Class 1. Simple radiation reactions of the skin
Class 2. Dyskeratosis and dysplasia of the epidermis.
Class 3. Carcinoma *in situ*.
Class 4. Definite invasive carcinoma but cases in which the malignant lesion is localized.
Class 5. Carcinoma with either extensive local invasion or distant metastases.

The epidermal changes consisted of atrophy, acanthosis, hyperkeratosis, and occasionally parakeratosis. Dyskeratosis and dysplasia are the criteria used for the establishment of Class 2. In this category are included those cases in which there is evidence of atypical growth but no definite evidence of carcinoma. Dyskeratosis is manifested by abnormality in differentiation and maturation of the epithelial cells as they migrate from the basal layer to the cornified surface, and is usually evidenced by abnormalities of keratinization, either unequally or prematurely. The normal cellular architecture is disturbed and change in polarity of cells is common. Dysplasia is a much more serious process and is the term applied to the presence in the epidermis, usually in the deeper layers, of abnormal and atypical forms, and occasionally, in the severe changes, of abnormalities of the basement membrane. The authors feel that in the future more of the examples placed in Class 2 will be placed in Class 3 as definite carcinoma *in situ*.

Degenerative changes in the corium are due first to the effects of irradiation and second to the obliterative endarteritis with resulting diminution of blood supply, the latter probably being the more important process. In the present study, the vascular changes were the most constant, the earliest, and the most pronounced seen in the skin. They provide a reliable criterion of the degree of irradiation damage.

The early changes in the stroma are non-specific and similar to those of any inflammatory process. As the vascular changes progress, secondary degenerative phenomena result from the ischemia. In the milder degrees of radiodermatitis, there is an apparent increase in the elastic fibers, while in the late and more severe cases these fibers are decreased.

The hair follicles and sebaceous glands are very sensitive to radiation, the sebaceous glands being more sensitive than the hair follicles, while the sweat glands are the most resistant of the dermal appendages. Except in the cases of most severe injury, sweat glands can be demonstrated in the histologic sections. In most cases, they show abnormal change and provide an excellent index of the degree of injury.

The biologic behavior of squamous-cell carcinoma originating in an irradiated area does not differ greatly from any other squamous-cell carcinoma, but as a result of the changed environment there are important differences imposed on the tumor. Carcinoma due to irradiation is of a low degree of malignancy. Infiltration of tissue is slow, due to the marked stromal reaction with fibrosis and hyalinization of the corium. The severe vascular reaction, with sealing off of the arteriolar channels and lymphatics by endothelial proliferation and thrombosis, further inhibits the spread of the neoplasm. Consequently, irradiation carcinoma is usually a local process. Extensive localized spread or distant metastases may occur, however, as a result of neglect or of inadequate therapy. Treatment by further irradiation or fulguration in this type of carcinoma is obviously futile.

The authors present evidence supporting the direct carcinogenic effect of radiation on the epidermal portion of the skin.

Sixteen photomicrographs; 6 tables.

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Epithelioma and Papilloma Arising on Recently Irradiated Skin. Report of Three Cases. J. Walter. Brit. M. J. 1: 273–274, Feb. 4, 1950.

Three cases are reported of papilloma or epithelioma developing in treatment fields within a few months after x-ray reactions of moderate severity.

In Case I 3,450 r were given to each side of the neck and 1,200 r from the back, directed to a carcinoma of the larynx. Fourteen weeks later a skin nodule appeared which was removed and called a simple squamous papilloma.

In Case II a Grade 1 epithelioma developed on a treatment field which had received a skin dose of 3,900 r in thirty-three days. The nodule appeared eleven weeks after the end of treatment. The primary lesion was a Grade 2 carcinoma of the hypopharynx.

Case III received 3,500 r on the skin of the neck for metastatic nodes containing anaplastic carcinoma. A Grade 1 epithelioma appeared within seven weeks.

The various possibilities are discussed but no conclusion is reached. If these tumors were metastases, they should have shown a higher grade of malignancy than the primaries but in each the grade was lower. If they had been latent in the skin before therapy, they should have been destroyed. They were not late effects, since the tissues did not show fibrosis and obliteration of the vessels. If they were due to some stimulating

effect of x-ray, many more cases should have been reported. Finally there was no carcinogenic agent applied locally—only penicillin cream for about two weeks.

One photograph; 6 photomicrographs.

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Use of Anticoagulant (Dicumarol) in Preventing Post-Irradiation Tissue Changes in the Human Lung. Preliminary Report. Stanley H. Macht and Harry Perlberg, Jr. Am. J. Roentgenol. **63:** 335–341, March 1950.

Experimental evidence has shown a marked diminution of pathologic changes in pulmonary tissues subjected to irradiation after heparinization. On the basis of this evidence, the authors hit upon the plan of using dicumarol in a patient undergoing radiation therapy for carcinoma of the esophagus. Death intervened with only half of the expected dose administered. Pathologic examination showed marked reaction in the tumor *per se* but no reaction in the lung parenchyma.

In an addendum the authors report briefly 2 additional cases of esophageal carcinoma and 6 of carcinoma of the lung in which dicumarol was administered, beginning before and ending after the course of roentgen therapy.

The conclusion is reached that (1) dicumarol will prevent radiation reaction in normal lung tissue up to the limit of skin tolerance. Since patients given dicumarol in association with roentgen therapy are extremely difficult to maintain on a constant prothrombin level, they should be kept under careful hospital observation during the entire treatment course.

Thirteen illustrations, including 3 roentgenograms; 1 table.

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Hemolytic Effect of Radiation. Observations on Renal Bile Fistula Dogs Subjected to Total Body Radiation and on Human Blood Irradiated in Vitro. R. Wendell Davis, Nieves Dole, Mary Jane Izzo, and Lawrence E. Young. J. Lab. & Clin. Med. **35:** 528–537, April 1950.

Four dogs in whom renal bile fistulas had been produced by anastomosis of the gallbladder to the renal pelvis were exposed to total body irradiation in single doses of 150 r (1 dog) and 250 r (3 dogs). The excretion of bilirubin in the urine by each of the 4 dogs increased significantly during the first or second week following exposure. Possible sources of the increments in bilirubin output are discussed, and it is considered that accelerated destruction of mature erythrocytes could be neither established nor disproved by these experiments. It is regarded as likely that some bilirubin is derived from destruction of partly hemoglobinized normoblasts in the marrow. It is also suggested that somewhat more than the normal portion of the total bilirubin excretion might stem from hemoglobin precursors if such molecules should be less successfully incorporated into erythroid cells after irradiation.

The morphology of the red cells did not appear to be altered in any of the irradiated dogs, and serial measurements of osmotic and mechanical fragility of the erythrocytes revealed no significant alterations after irradiation in the two dogs tested. Reticulocytosis and erythrophagocytosis could not be detected in smears of venous blood prepared after exposure.

Ten milliliter aliquots of heparinized blood from a normal human donor were exposed *in vitro* to x-radiation in doses ranging from 10 to 20,000 r. The osmotic and mechanical fragility of the red cells was normal when tested immediately after irradiation and again after incubation at 37° C. for twenty-four hours following exposure, except in the sample treated with 20,000 r, which showed slightly greater than normal increase in osmotic fragility after incubation. Rates of autohemolysis and glycolysis during incubation *in vitro* were neither accelerated nor decelerated by irradiation of the blood prior to incubation.

It is emphasized that any alterations produced in erythrocytes *in vitro* by very large doses of x-radiation may be unrelated to the effects, if any, which very small doses have on mature red cells *in vivo*. It is concluded that new experimental approaches must be utilized to determine whether radiation has a truly hemolytic effect on mature red cells *in vivo*.

One illustration; 1 table.

Quantitative Inferences Concerning the Genetic Effects of Radiation on Human Beings. Robley D. Evans. Brit. J. Radiol. **23:** 175–183, March 1950.

By extrapolation from known facts of human genetics the author finds it unlikely that any increase in hereditary anomalies will occur, even after many generations, from daily doses of radiation up to 0.1 r given to a small fraction of the population.

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